

A RAND NOTE

**Design of Field-Based Crosstraining
Programs and Implications for Readiness:
Survey Instrument and Database Documentation**

Rebecca M. Mazel

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

BEST AVAILABLE COPY

RAND

20041208 242

The research described in this report was sponsored by the United States Army under Contract No. MDA903-91-C-0006.

RAND is a nonprofit institution that seeks to improve public policy through research and analysis. Publications of RAND do not necessarily reflect the opinions or policies of the sponsors of RAND research.

A RAND NOTE

N-3600-A

**Design of Field-Based Crosstraining
Programs and Implications for Readiness:
Survey Instrument and Database Documentation**

Rebecca M. Mazel

**Prepared for the
United States Army**

RAND

12

Approved for public release; distribution unlimited

PREFACE

As part of a broad effort to reduce defense expenditures, the Army is exploring a number of new approaches to training soldiers. Prominent among these approaches to streamline individual training are elements involving the combination of two or more occupational specialties and the shifting of initial skill training from Army schools to on-the-job training (OJT) in field units. RAND report R-4242-A, *Design of Field-Based Crosstraining Programs and Implications for Readiness*, by William G. Wild, Jr., and Bruce R. Orvis, describes a methodology for analyzing the features, advantages, and disadvantages of such changes in training programs. Focusing on the specific case of helicopter maintenance, the report analyzes data from field units and recommends alternative training strategies that could achieve the savings intended for such programs at reduced risk to field readiness. This Note documents the survey instruments and data sources used to support the analyses described in R-4242-A.

The research was sponsored by the U.S. Army Training and Doctrine Command, Office of the Deputy Chief of Staff for Training. It was conducted within the Arroyo Center's Manpower and Training Program.

THE ARROYO CENTER

The Arroyo Center is the U.S. Army's federally funded research and development center for studies and analysis operated by RAND. The Arroyo Center provides the Army with objective, independent analytic research on major policy and management concerns, emphasizing mid- to long-term problems. Its research is carried out in four programs: Strategy and Doctrine, Military Logistics, Manpower and Training, and Force Development and Technology. Army Regulation 5-21 contains basic policy for the conduct of the Arroyo Center. The Army provides continuing guidance and oversight through the Arroyo Center Policy Committee, which is co-chaired by the Vice Chief of Staff and by the Assistant Secretary for Research, Development, and Acquisition. Arroyo Center work is performed under contract MDA903-91-C-0006.

The Arroyo Center is housed in RAND's Army Research Division. RAND is a private, nonprofit institution that conducts analytic research on a wide range of public policy matters affecting the nation's security and welfare.

Lynn E. Davis is Vice President for the Army Research Division and Director of the Arroyo Center. Those interested in further information concerning the Arroyo Center should contact her office directly:

Lynn E. Davis
RAND
1700 Main Street
Santa Monica, CA 90407-2138
Telephone: (310) 393-0411

CONTENTS

PREFACE	iii
FIGURES AND TABLES	vii
Section	
1. INTRODUCTION	1
Background: Changes in Individual Training	1
Surveys and Official Data Sources	2
2. SURVEYS	4
Design Background	4
General Survey Specifications	5
Background Section	5
Other Maintainer Survey Sections	6
Other Supervisor Survey Sections	8
Administering the Surveys	11
3. OFFICIAL DATA SOURCE SPECIFICATIONS	13
EMF Data	13
UMSDC Data	14
WOLF Data	14
4. INTERRELATING SURVEYS AND OFFICIAL DATA SOURCES	16
Appendix	
A. MAINTAINER SURVEY INSTRUMENT	17
B. SUPERVISOR SURVEY INSTRUMENT	33
C. MOS SPECIFIC TASK LISTS	49
BIBLIOGRAPHY	119

FIGURES

2.1. Maintainer Survey Task-Specific Workload Response Format	8
2.2. Supervisor Survey Task-Specific Train-up Response Format	9
4.1. Interrelating Survey and Official Maintenance Data Sources	16

TABLES

2.1. Helicopter Maintenance Specialties	4
2.2. Survey Sections	5
2.3. Maintainer Surveys Completed by MOS and Site	12
2.4. Supervisor Surveys Completed by MOS and Site	12

1. INTRODUCTION

BACKGROUND: CHANGES IN INDIVIDUAL TRAINING

In the current environment of defense spending reductions, the training community is concerned with accomplishing its mission with reduced resources. One effort to improve cost-effectiveness involves changes in two fundamental elements of individual training:

- **Shifting Advanced Individual Training (AIT) from the classroom to field On-the-Job Training (OJT).** This shift involves (1) shortening the school courses and reorienting them to emphasize general skills, and (2) relying on formal OJT programs at field units to compensate for the reduction in school training.
- **Consolidating Military Occupational Specialties (MOSs).** This change reduces specialization, both in the training and personnel systems. When training time is held constant, consolidation trades off task exposures used to develop specialized skills for exposure to a wider range of tasks that engenders breadth of general skills and is consonant with a more general AIT curriculum.

Such changes have a number of anticipated benefits. These include the cost savings associated with reducing the length and number of AIT courses and increased flexibility in assigning individuals to tasks and units. However, the changes also pose potential risks to mission effectiveness. AIT graduates enter the unit with less MOS-relevant background, thereby making their "train-up period" at the unit longer. During this time they may require more supervision and perform less proficiently. The risk is heightened when training time must be split among an increased number of tasks currently performed by distinct MOSs.

Understanding the potential benefits and risks of such changes is the subject of R-4242-A, *Design of Field-Based Crosstraining Programs and Implications for Readiness*, by William G. Wild, Jr., and Bruce R. Orvis. In the report, an analytical framework is developed and applied to the types of changes underlying the Apprentice Mechanic Initiative (AMI), a proposed program for helicopter maintenance personnel that includes major changes in both training elements described earlier: classroom to OJT shift and MOS consolidation. The report suggests options that could decrease potential risks of programs like AMI while capturing many of the desired benefits. This Note provides additional detail on the methods and data sources used in our analyses.

SURVEYS AND OFFICIAL DATA SOURCES

Our study used two forms of data: (1) data collected via specially designed survey instruments, and (2) existing maintenance data and personnel records. Two types of surveys were developed to better understand overall unit operations and conditions: a maintainer survey and a supervisor survey. We were interested specifically in obtaining a more detailed picture of the maintainers who make up the aviation unit in terms of their experience, training, and other demographics; the breakdown of duty time spent on maintenance versus nonmaintenance tasks; frequency and types of jobs performed; and work performed on tasks normally considered outside their MOS. We queried supervisors concerning their job responsibilities; perceptions of train-up requirements (both task-specific and in general for a given MOS); comparative job performance times and supervision requirements for maintainers with varying experience levels; and perceptions of which MOSs might be combined in future training.

We also used several existing databases. To capture data for enlisted personnel management and strength accounting, we used the Enlisted Master File (EMF), the official Department of the Army information base for enlisted personnel. Among other variables, we were interested in unit personnel strengths, skill mix, and experience levels.

To understand the overall workload and job responsibilities of the maintenance units of interest, existing data collected during actual unit operations were obtained and analyzed. These data include information from the Army's Aviation Unscheduled Maintenance Sample Data Collection (UMSDC) system and the Standard Army Maintenance System's (SAMS) Work Order Logistic File (WOLF).

UMSDC is one of two data collection systems developed by the Army to collect operational and maintenance information on a select number of systems in the field environment. Known as a "life-cycle" database, UMSDC tracks detailed information regarding all maintenance actions at a selected group of aviation units (targeted AVUM units and the AVIM units that service them). Data are collected via modified TAMMS (The Army Maintenance Management System) forms and ACMR (Aircraft Corrective Maintenance Record) forms. Data collection is managed by a field monitor (normally an outside contractor) who performs extensive quality control procedures, a hallmark element of the UMSDC system.

Whereas coverage of AVUM activity is thought to be well documented in the UMSDC, AVIM coverage is not as complete. To investigate possible differences in training opportunities and workload across AVIM units, we turned to the WOLF data. SAMS data are collected and maintained at every aviation unit, and are organized by USAMC Materiel

Readiness Support Activity (MRSA) into the WOLF database system. WOLF provides an "on-line" centralized database of Table of Organization and Equipment (TO&E) direct support/general support (DS/GS) work-order information. The WOLF is generally used for current DS/GS maintenance information on a variety of fielded equipment, including helicopters.

Section 2 describes the survey development and administration. The actual survey text and response formats are included in the appendixes. Section 3 provides details concerning the official data sources and their use in this research. Section 4 describes the interrelating of the survey and official record data.

2. SURVEYS

DESIGN BACKGROUND

Two types of survey instruments were designed. The first obtains information about the specific tasks performed by maintainers in a given MOS and the naturally occurring frequencies of those tasks. The survey is to be completed by skill level (SL)10 soldiers with varying experience levels, in this instance, from each of the 17 helicopter maintenance MOSs. (See Table 2.1 for a list of the participating MOSs.) The second survey was designed to determine how long it takes individuals to train up on specific tasks in a given MOS area and to yield relative ratings of task difficulty. The second survey is to be completed by SL20 supervisors for each MOS.

The surveys were designed to answer several specific questions:

- What are the characteristics of unit members (including individual experience profiles—e.g., years of service—and general demographics)?
- What is the typical use of duty time (maintenance vs. non-maintenance duties, division of maintenance duty time between scheduled and unscheduled maintenance activities, etc.)?

Table 2.1
Helicopter Maintenance Specialties

<i>67 Series General Helicopter Mechanics</i>	
67N	UH-1 utility helicopter
67R	AH-64 attack helicopter
67S	OH-58D scout helicopter
67T	UH-60 tactical transport helicopter
67U	CH-47 medium helicopter
67V	OH-58A/C scout helicopter
67Y	AH-1 attack helicopter
<i>68 Series Component Specialists (Subsystem Repairers)</i>	
68B	Power plant repairer
68D	Powertrain repairer
68F	Aircraft electrician
68G	Structural repairer
68H	Hydraulic/pneudraulic repairer
68J	Armament repairer
68N	General avionics repairer
68L	Avionics communication equipment repairer
68Q	Avionics flight control repairer
68R	Avionics navigation equipment repairer

- What actual types and amounts of tasks are performed by SL10 maintainers of a given MOS, experience level, and unit level (e.g., AVUM vs. AVIM)?
- To what extent does MOS cross-utilization already occur?
- How many task exposures and how much time does it take to train up maintainers on specific tasks in their specialty, and in each MOS generally?
- What are the comparative performance times and supervision requirements for maintainers with different experience levels?
- Where would the respondents recommend MOS consolidation?

GENERAL SURVEY SPECIFICATIONS

The maintainer and supervisor surveys consist of several sections. Both begin with a series of common "background" items. The background and ensuing sections are outlined in Table 2.2 and then described in greater detail. The actual question wordings and response formats can be found in Appendixes A and B.

BACKGROUND SECTION

To directly answer our first two questions, we constructed questionnaire items regarding basic demographics (e.g., age, gender, education), experience level, pay grade, amount and type of training, MOS assignment, general description of supervision (given and received), and a breakdown of duty time spent on maintenance vs. nonmaintenance activities. Specific wordings for all background items are shown in Appendix A.

Table 2.2
Survey Sections

<i>Maintainer Survey</i>
Background
Scheduled maintenance
MOS task-specific workload
Distribution of work across aircraft types
General MOS-related work
<i>Supervisor Survey</i>
Background
MOS task-specific train-up
General train-up time
MOS consolidation
Comparative job performance

OTHER MAINTAINER SURVEY SECTIONS

Scheduled Maintenance

Since much of a maintainer's duties were assumed to be regular scheduled maintenance activities—the content of which is well documented—we concentrated our effort on obtaining data regarding the time spent on such activities. Items ask maintainers to indicate how often they work on specific forms of scheduled maintenance (such as phase inspections, daily checks and services, 10-hour/14-day inspections, and Modification Work Orders (MWOs)) as well as to provide an overall breakdown between time spent on scheduled and unscheduled maintenance. The specific wording of these items appears in Appendix A.

MOS Task-Specific Workload

To assess the actual types and amounts of tasks performed by SL10 maintainers, we developed the MOS task-specific section of our surveys. From these data, specific questions such as "Could the workload in the field support an increased amount of OJT?" and "Are maintainers of different experience or unit levels involved in distinctly different types of work (e.g., troubleshooting vs. removal/replacement)?" can be addressed.

This section makes up the core of the maintainer survey. It consists of a list of the key parts or jobs worked on by maintainers in a given MOS. In some cases, there are several hundred parts or jobs listed. However, although each MOS-specific list is intended to be comprehensive, only a portion of the list would apply to any given respondent.

The parts/job lists were grouped based on a subsystem organization (e.g., all parts having to do with the drivetrain system of an aircraft are found in a group called "Drivetrain"). For MOS 68-series surveys, the groups were delineated along aircraft as well as subsystem lines where possible. However, official documentation did not provide an aircraft-specific distinction for some MOSs (68F, 68G, 68H, 68N, 68L, 68Q, and 68R). To collect information about what specific aircraft these MOSs worked on, a separate general question was asked (see "Distribution of Work Across Aircraft Section" described below).

The parts/job lists were generated from official Army documentation (including Soldier Technical Manuals and Maintenance Allocation Charts) and Army Occupational Survey Program (AOSP) questionnaires, with subject matter expert (SME) review provided by Fort Eustis Aviation Logistics School instructors, schoolhouse personnel, and field noncommissioned officers (NCOs) assigned there for advanced training. Each list represents the tasks performed by a particular MOS, with one exception. The exception involved using

a single list to represent all of the MOSs specializing in helicopter avionics (68N, 68L, 68Q, and 68R).¹

To be sure that we did not miss critical jobs currently performed in active units, two additional items were included for every group of subsystem parts/jobs. The first item allowed respondents to answer about "components not listed above" for a given group of subsystem parts. The second, termed "general work," allowed respondents to report information on a full system level (e.g., "troubleshooting the hydraulics system"). Finally, a group at the end of each MOS-specific parts/job list allowed for any additional work not listed or which did not fit into any of the subsystem groups. In total, 14 MOS-specific lists were developed. These lists are found in Appendix B. The response formats (including an example of the general items) are found in Appendix A.

With these lists, we expected to obtain a detailed picture of the tasks performed by individual maintainers. This was accomplished by asking the following three questions for each task:

- How often in the last six months did you work on the listed part/job?
- Of the times you worked on this part/job, how many times were you involved in troubleshooting, removal/replacement, and repairing?
- On average, each time you performed troubleshooting, removal/replacement, or repairing for this part/job, how much time did you spend?

Respondents were asked to record their responses on a response grid similar to the one shown in Figure 2.1. They were asked to restrict their answers to tasks personally performed in the last six months (or where Operation Desert Storm (ODS) had caused changes, a typical six-month period) and to consider "unscheduled" maintenance only (including maintenance arising out of scheduled inspections, but not the inspections themselves). To review exact question wordings and formats, please see Appendix A.

Distribution of Work Across Aircraft

The task list available for MOSs 68F, 68G, 68H, 68N, 68L, 68Q, and 68R did not distinguish the various aircraft in the inventory. As a consequence, we included a special

¹During survey development, resources for the development of the avionics surveys were not readily available. In addition, these specialties were not taught at Fort Eustis and are not included in the field-based training program it proposed. Thus, a single list was developed similar to the most recent AOSP survey for these specialties. A more detailed (MOS-specific) task list for these "high-tech" specialties would be recommended if the training for these MOSs were to be consolidated with each other or with other MOSs.

	HOW MANY TIMES IN THE LAST 6 MONTHS					OF THESE, NUMBER INVOLVING.....			ON AVERAGE, HOW LONG EACH TIME?		
	1	2	3-5	6-10	>10	T-SHOOT	R/R	REPAIR	T-SHOOT	R/R	REPAIR
Job/Part											
Tail Rotor Assembly											

Figure 2.1—Maintainer Survey Task-Specific Workload Response Format

section for these specialties in which maintainers were asked to indicate how many days they work on each aircraft on average, and on such days, how many hours they work on the aircraft. This information allowed us to allocate their work time accordingly. Specific item wordings and formats are found in Appendix A. Data from these items can be used to clarify the types and amounts of tasks performed by individuals across the various MOSs.

General MOS-Related Work

Because a major element of future training programs may involve combining MOSs, this section was designed to investigate where “natural” MOS cross-utilization might already occur in the field. Two lists of subsystem areas were developed from the core parts/job lists discussed above. The first list includes all of the major component areas of the aircraft (from airframe to weapons delivery systems) and the second list includes a “scheduled maintenance” and an “unscheduled maintenance” item for each of the seven aircraft maintained by the 67-series MOSs.

We asked the 68-series component specialists to answer questions about the first list (containing various components) to gather data on work performed outside their component-specific specialty. The 67-series general aircraft maintainers were asked to complete the second aircraft list, indicating work on aircraft outside their MOS-specified training.

For both lists, as with the MOS task-specific workload section, maintainers were asked to indicate how often they worked in each area; when they did work in each area, how many times the work involved troubleshooting, removal/replacement and repair; and, on average how much time they spent on each function. A copy of each formatted list with questions is found in Appendix A.

OTHER SUPERVISOR SURVEY SECTIONS

MOS Task-Specific Train-up

This section concerns what it takes to train up new maintainers. Supervisors were asked to provide detailed information about how much exposure and time it takes to train maintainers to perform tasks specific to their MOS. Questions concerned the same tasks

developed for the maintainer surveys. In this way, exposures needed for train-up (reported by supervisors) could be compared with the frequency of exposure to the tasks (reported by maintainers), as well as with the task frequencies recorded in official data sources (to be discussed in the next section). Three questions were asked for each job/part for each of the three functions:

- How many months after arrival in the unit could a typical new AIT graduate start to be trained on this task (begin working with supervision)?
- After his first exposure to this task, how many months would typically be required before he is able to perform it independently?²
- How many exposures to this task are typically needed before an individual is able to perform it independently?

Supervisors were asked to record their responses on a response grid as shown in Figure 2.2 below. They were asked to restrict their answers to tasks they supervise at least twice in a typical six-month period and to include work arising from scheduled and unscheduled maintenance. Exact question wording and sample response formats are found in Appendix B.

General Train-up Time

Another measure was developed to provide a rough overall view of train-up time in a given MOS, regardless of the specific tasks involved. This section asks supervisors to draw from their individual experience with maintainers and to rate the amount of the day-to-day maintenance duties a maintainer at various experience levels (3, 6, 9, 12, 18, 24, and 36

	REMOVE/REPLACE			TROUBLESHOOT			REPAIR		
	MONTHS		NUMBER	MONTHS		NUMBER	MONTHS		NUMBER
	UNTIL	TRAINING	EXPOSURES	UNTIL	TRAINING	EXPOSURES	UNTIL	TRAINING	EXPOSURES
JOB/PART	START	DURATION	NEEDED	START	DURATION	NEEDED	START	DURATION	NEEDED
Tail Rotor Assembly									

Figure 2.2—Supervisor Survey Task-Specific Train-up Response Format

²Performing a task independently was defined for supervisors as being able to perform the task without "over-the-shoulder" supervision.

months since graduating AIT) is able to perform with minimal direct supervision. To accommodate various perceived aptitude levels, ratings were requested for "average," "fast," and "slow" learners. Specific wording is found in Appendix B. Future research might benefit from the inclusion of a "train-up" question like this for each subsystem area.

MOS Consolidation

To gather perceptions of candidate MOS combinations, this section asks supervisors to indicate what (if any) MOSs they thought could logically be combined with their own. Respondents were told that the Army was considering reducing the number of MOSs for first-term maintainers by combining them, making these personnel less specialized than at present. This training would include a broader range of tasks at the basic level. Respondents were given sample reasons why one MOS might be combined with another. The actual wording and item formatting are found in Appendix B.

Comparative Job Performance

Two risks of shifting training from the classroom to the field are the increased burden on supervisors and the potential for decreased unit capability. Thus, we are interested in quantifying how supervision requirements and the amount of time needed to perform a given task vary with length of experience. To assess these concepts, we modified a questionnaire used to assess job performance of U.S. Air Force maintenance personnel in a previous RAND study. In the original questionnaire, supervisors were asked to rate their subordinates against each other on a series of jobs with respect to performance time and supervision requirements. Because of sampling constraints in our study, we asked supervisors to consider maintainers they currently supervise as well as those they have supervised in the past when responding to the modified questionnaire.

For each *group* of parts/jobs to which a supervisor had responded in the MOS task-specific train-up section (i.e., he supervised work in this area), he was asked to respond to a series of questions. The first step was to consider work in the group as performed by an "average" maintainer with 24 months experience since AIT, and to indicate the amount of direct supervision necessary to ensure that one hour of work on tasks of this type was done properly. Next, supervisors were asked how long it would take an average maintainer with less experience (18, 12, 6, and 3 months since AIT) to perform the same amount of work on the parts/jobs that the maintainer with 24 months of experience performed in one hour. For each of these experience levels, they also were asked to estimate the amount of supervision necessary to ensure that the jobs were completed properly. Each response was recorded in

hours and minutes. This information was collected for the three functions "remove/replace," "troubleshoot," and "repair."

One weakness with the modified approach includes the increased potential for supervisors to stereotype maintainers with different amounts of experience. This problem is minimized in the original version, which obtained supervisors' ratings of their individual subordinates. We recommend the original format when sample sizes permit its use.

ADMINISTERING THE SURVEYS

Small groups of maintainers and supervisors (in separate sessions) were given a brief background description of the project and the proposed test of AMI as well as oral survey instructions before completing the surveys. Several survey administrators remained during the sessions to answer questions.

The distribution of survey participants is shown in Tables 2.3 and 2.4. We experienced problems obtaining access to a large, fully representative group of respondents. The surveys were developed when Operation Desert Shield was well under way and at the onset of Operation Desert Storm. Survey sessions necessarily were conducted at maintenance units remaining in CONUS, which limited the number of respondents and coverage of high-technology helicopters. Understandably, unit mission requirements relating to ODS further precluded fully representative participation of unit personnel.

To augment the survey results, focus groups and personal interviews were conducted with unit commanders, maintenance supervisors, technical inspectors, and quality control officers to gain further insight into unit operations and conditions.

Table 2.3
Maintainer Surveys Completed by MOS and Site

MOS	Survey Site				MOS Total
	Fort Carson	Fort Ord	Fort Polk	Fort Hood	
67N	10	3	3	0	16
67R	0	0	0	0	0
67S	1	0	0	0	1
67T	4	4	3	0	11
67U	0	0	0	0	0
67V	3	8	3	0	14
67Y	7	7	9	1	24
68B	1	3	1	1	6
68D	1	4	4	2	11
68F	1	3	1	0	5
68G	1	3	2	3	9
68H	0	1	1	0	2
68J	9	4	1	5	19
68N	2	1	4	0	7
68L	1	1	4	1	7
68Q	1	0	0	1	2
68R	1	1	0	0	2
Site total	43	43	36	14	136

Table 2.4
Supervisor Surveys Completed by MOS and Site

MOS	Survey Site				MOS Total
	Fort Carson	Fort Ord	Fort Polk	Fort Hood	
67N	7	3	3	1	14
67R	0	0	0	1	1
67S	1	0	1	0	2
67T	1	3	0	1	5
67U	0	0	0	3	3
67V	1	5	1	1	8
67Y	3	4	2	1	10
68B	2	1	2	1	6
68D	2	1	1	2	6
68F	1	1	1	0	3
68G	1	1	3	1	6
68H	0	1	2	0	3
68J	2	1	5	3	11
68N	2	3	1	0	6
68L	0	1	0	1	2
68Q	0	1	0	1	2
68R	1	1	0	1	3
Site total	24	27	22	18	91

3. OFFICIAL DATA SOURCE SPECIFICATIONS

To gain a detailed picture of overall maintenance activity, we examined official data collected by the Army in AVIM and AVUM units of interest. With the use of EMF, UMSDC, and WOLF data, we hoped to answer the following questions (among others):

- What are specific unit manning patterns by MOS and pay grade?
- What type of work is performed by personnel of varying experience levels, unit types, and MOSs?
- What is the volume and mix of day-to-day maintenance workload?

EMF DATA

To gain insight into typical peacetime unit manning patterns, we used the September 1989 version of the EMF file. We chose to use the end of FY89 file rather than the FY90 file to avoid patterns of mobilization for ODS. With this file, we were able to view the actual manning in units, as opposed to using TO&E data, which represent personnel requirements rather than assignments. We chose 14 units, representing four corps and 10 divisional units, located in CONUS and Europe.

The EMF is a "snapshot" of all active duty soldiers, as well as personnel who have separated during the previous 120 days. We selected key variables from this file to allow us to develop a picture of the manning in units of interest. The variables we selected represented:

- Individual status, such as enlisted, primary and duty MOS, additional skill identifiers (ASI), pay grade, and length of current enlistment.
- Unit assignment data, such as unit identifier, location of unit, and date assigned to unit.
- Experience data, such as original date of active Army service, date assigned current primary MOS, and date reached current pay grade.

Using these data, we calculated additional variables to reflect constructs such as time in primary MOS, time in the Army, and time in current unit. By analyzing data from a variety of units, a picture of the typical unit was developed and used as a baseline from which to model changes that would occur under various new training scenarios.

UMSDC DATA

We obtained 30 months of UMSDC data, covering January 1988 through June 1990. These data included the maintenance actions for seven helicopters—AH-1F, AH-64A, CH-47D, OH-58C, OH-58D, UH-1H, and the UH-60A¹—for all units reporting in the UMSDC system. These units included selected AVUM units and their affiliated AVIM units. We analyzed the “event” files (EV) from the UMSDC Maintenance data. The EV files included:

- **30 Events.** General information for each maintenance activity (e.g., unit number, unit level, National Stock Number (NSN), and Work Unit Code (WUC)).
- **80 Events.** Man-hour and function data for each action according to who performed the action (using the Personnel Identifier Code (PIC)).
- **Personnel Roster.** MOS, experience level, skill level, pay grade, unit identifier, for each person identified by the PIC from the EV80.²

Our UMSDC analysis file was created by merging data from the EV30 records, the EV80 records, and the personnel roster, creating a file of maintenance person-actions.³ The EV30 and EV80 records were matched by the maintenance control number (which uniquely identified each activity), and then were matched to the personnel roster by the PIC.

To answer our earlier questions regarding the types and amounts of work performed by personnel of varying experience and MOSs, we used this basic person-action file to produce overall frequency counts of person-actions according to pay grade and MOS. In addition, these frequencies were compared across unit types (AVIM vs. AVUM) to assess comparability of work, an essential issue if training in one level of unit is intended to provide trained maintainers for the other.

WOLF DATA

To provide additional information for AVIM units, we used specially selected WOLF data that covered 18 months, from January 1989 through June 1990, and included information for 79 units in CONUS and Germany, at the corps and division levels. From the WOLF data, we analyzed the following files:

¹The aircraft in this analysis are also known as the Cobra (AH-1), Apache (AH-64), Chinook (CH-47), Kiowa (OH-58C), 58-Delta (OH-58D), Huey (UH-1), and Black Hawk (UH-60).

²We obtained the personnel roster with the UMSDC data. However, it is maintained in every unit and is not a database solely for UMSDC.

³We also evaluated the EV40 records, but found they generally overlapped with the EV30 records in reporting substantial maintenance actions, and that they included other inconsequential parts (e.g., washers, bolts, etc.). We thus excluded them from our primary analysis.

- **A Records.** Maintenance Summary—Work-order-based records, including work-order number, primary (end-item) part number, part name, and part NSN, various serial numbers, unit ownership identification, man-hours projected and expended, and quantity of parts to be repaired.
- **B Records.** Parts Summary—Parts-based records, including work-order number, individual part names and NSNs, and quantities, among other factors.

Using the A and B records, the data were merged using the work-order number to create an analysis file of maintenance actions.⁴ Since WOLF data do not contain detailed information on type of function or individual persons who performed the work, estimates from the UMSDC data were used to impute person-actions and functions from the maintenance actions reported in the WOLF data.

⁴We also evaluated the C Records containing work-order-based labor information. Since we were interested in component parts and the individuals working on these parts, the work-order labor record was not used.

4. INTERRELATING SURVEYS AND OFFICIAL DATA SOURCES

For some of the analyses described in R-4242-A, it was necessary to interrelate our survey data with the official maintenance data (UMSDC and WOLF). Our primary research goal in this respect was to compare train-up requirements with train-up opportunity; we used supervisor survey information on task train-up requirements, task workloads reported in the maintainer surveys, and task workloads derived from the UMSDC and WOLF data.

To compare the number of task exposures required for OJT train-up with the frequencies of these tasks in actual unit operations (according to the UMSDC and WOLF data), a link between the data sources needed to be established. Figure 4.1 illustrates in simple terms the key variables used to link the three types of files.

The tasks/components in the surveys were linked to the UMSDC data by matching the corresponding part nomenclature, using the subsystem component work unit codes (WUCs) as an organizational tool. This provided a great deal of information on AVUM unit operations, and some on AVIM. To capture the AVIM data reported in WOLF, we first used the parts selected in the match between the surveys and UMSDC data as a base. Next, we identified the NSNs that most closely matched the WUC nomenclature for the part or subsystem. Finally, we linked the WOLF and survey data using these selected NSNs.

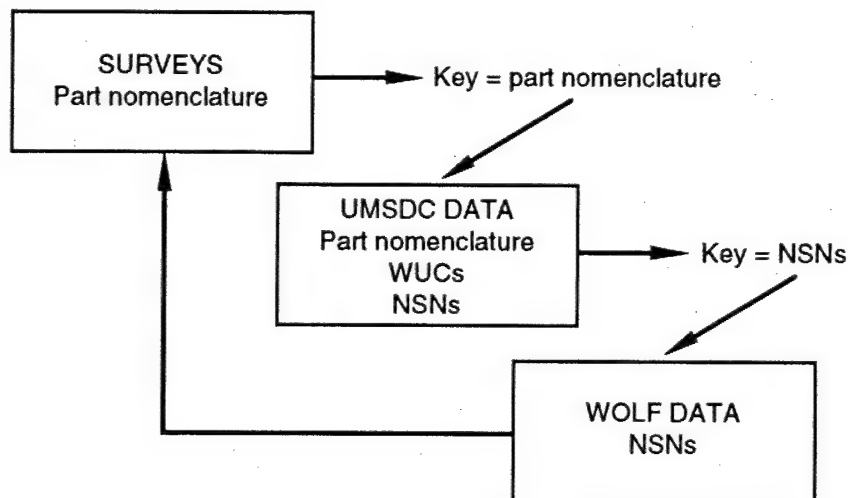


Figure 4.1—Interrelating Survey and Official Maintenance Data Sources

Appendix A
MAINTAINER SURVEY INSTRUMENT

Found in the following pages is the Maintainer Survey questionnaire as it was used in the field. The only section that does not appear in its entirety is the MOS task-specific workload section. Here the reader will find a single page sample that shows the format used. The complete task lists are found in Appendix C.

BACKGROUND SECTION

1. What is your primary MOS (e.g., 68B20, 67N10)? _____
2. What is your duty MOS? _____
3. When did you complete AIT/Transition Training for your current duty MOS?
_____/____ (MM/YY)
4. What unit are you currently assigned to (e.g., E CO 123rd AVN), and when did you arrive in this unit?

(Unit name) Date arrived? ____/____
(MM/YY)
5. What unit, if any, were you assigned to just prior to your current unit, and for what duration?

(Unit name) From? ____/____ To? ____/____
(MM/YY) (MM/YY)
6. What level of maintenance unit are you assigned to? (Circle One)
AVIM (Divisional) 1
AVIM (Non-Divisional) 2
AVUM 3
7. Is there ONE particular maintenance team to which you are primarily assigned (e.g., AVIM contact team, phase maintenance team, etc.)?
NO 1
YES 2
If YES, please specify: _____
8. Did you cross-train into the aviation maintenance career area?
(Circle one)
NO 1
YES 2
- 8a. If YES, please specify what MOS you worked in before cross-training and for how many years.
MOS: _____ How Long? _____ yrs
9. Do you have an ASI (Additional Skill Identifier) (e.g., X1, W5)?
Please Specify: _____

10. How many years of active military service in the Army do you have?
(Circle one)

Less than 3 months	..... 1	2-4 years	..... 5
3-6 months	..... 2	4-6 years	..... 6
7-11 months	..... 3	7 years or more	..... 7
12-24 months	..... 4		

11. What is your current rank (paygrade)? (Circle one)

PV1 (E1)	..... 1	SSG (E6)	..... 6
PV2 (E2)	..... 2	SFC (E7)	..... 7
PFC (E3)	..... 3	MSG/1SG (E8)	..... 8
SPC/CPL (E4)	..... 4	SGM/CSM (E9)	..... 9
SGT (E5)	..... 5		

12. How long have you worked in the aviation maintenance field?
(Circle one)

Less than 3 months	..... 1	2-4 years	..... 5
3-6 months	..... 2	4-6 years	..... 6
7-11 months	..... 3	7 years or more	..... 7
12-24 months	..... 4		

13. How long have you been assigned to your current duty position?
(Circle one)

Less than 3 months	..... 1	2-4 years	..... 5
3-6 months	..... 2	4-6 years	..... 6
7-11 months	..... 3	7 years or more	..... 7
12-24 months	..... 4		

14. What duty position title best describes the work you are currently doing? (E.g., senior mechanic, Powertrain repairer, electrical repair technical inspector, Safety NCO, AH-64 repair supervisor, etc.)

Please Specify: _____

15. How many hours are you on duty (maintenance and non-maintenance) on an average week?

_____ hrs

- 15a. Of the hours indicated above, how many hours do you spend working on each of the following?

DIRECT MAINTENANCE (NOT including completing forms, locating parts, administrative duty) _____ hrs

SUPERVISION OF OTHERS PERFORMING DIRECT MAINTENANCE _____ hrs

OTHER MAINTENANCE-RELATED DUTIES (including completing forms, locating parts, administration, and supervision of these duties) _____ hrs

NON-MAINTENANCE DUTIES _____ hrs

(Combined Total should be the same as Item 15 above)

Please Specify Non-maintenance duties below:

16. Of every 20 hours you spend on maintenance, about how many hours do you spend on each of the following?

AVUM Level Maintenance _____ hrs

AVIM Level Maintenance _____ hrs

(Combined Total should be 20 hours)

17. Roughly what fraction of your day-to-day direct maintenance tasks do you currently perform independently (without direct "over the shoulder" supervision)? (Circle one)

Very little or none 1

Some 2

About half 3

Most 4

Almost all or all 5

18. How many people do you directly supervise in each of the following paygrades?

E1 _____ E4 _____ E7 _____
E2 _____ E5 _____ E8 _____
E3 _____ E6 _____ E9 _____ None Supervised _____

- 18a. If you directly supervise others, what MOS's do you supervise?
(Circle all that apply)

67 Series: 67N 67R 67S 67T 67U 67V 67Y
68 Series: 68B 68D 68F 68G 68H 68J 68L 68N 68Q 68R

19. What is your sex? (Circle one)

Male 1 Female 2

20. How old were you on your last birthday? _____ yrs

21. What is your highest level of education? (Circle one)

Elementary school (grades 1-8) 1
Some high school or some technical training 2
GED (General Educational Development) 3
Graduated high school (received regular diploma)... 4
2 year or less of college (no degree) 5
Two-year associate degree (AA) 6
More than 2 year off college (no degree) 7
Four-year college degree (BA, BS) 8
Some gradate school 9

SCHEDULED MAINTENANCE SECTION

SCHEDULED MAINTENANCE (INSPECTIONS)

For the following items, you will be asked to answer questions about how much of your time you spend performing various types of **scheduled maintenance**. We are interested in both specific types of scheduled maintenance, as well as the overall split of your time spent on scheduled versus **unscheduled** maintenance work.

1. Please indicate in the grid at the bottom of the page **HOW OFTEN**, on average, you work on each type of inspection indicated there. Mark your responses in the "Item 1" column, choosing from the following:
 - A. Less than 1 day/month
 - B. 1-2 days/month
 - C. 1 day/week (3-6 days/month)
 - D. 2 days/week (7-10 days/month)
 - E. 3 days/week (11-14 days/month)
 - F. 4 days/week (almost every work day)
 - G. 5 days/week (every work day)
2. On an average day when you work on this type of inspection, about **HOW MANY HOURS** do you spend? Mark your response in the "Item 2" column, choosing from the following:
 - A. Less than 1 hour
 - B. About 1 hour
 - C. 1 1/2 hours
 - D. 2 hours
 - E. 3 hours
 - F. 4 hours
 - G. 5 hours
 - H. 6 hours
 - I. 7 hours
 - J. 8 hours or more

	HOW OFTEN (Item 1)	AVG. HOURS (Item 2)
Phase/Periodic		
Daily checks, services		
10 hr/14 day checks, services		
Modification Work Orders (MWOs)		
Other scheduled (not listed)		

3. Overall, of every 20 hours you spend on maintenance, about how many hours do you spend on each of the following?

Scheduled Maintenance Inspections hrs

Unscheduled Maintenance, and work
arising from scheduled inspections hrs

(Combined Total should be 20 hours)

MOS TASK-SPECIFIC WORKLOAD SECTION

WHEN YOU REACH THIS PAGE, PLEASE STOP AND RAISE YOUR HAND.

**THE SURVEY ADMINISTRATORS WILL GIVE THE NECESSARY
INSTRUCTIONS TO COMPLETE THIS SECTION.**

MOS TASK-SPECIFIC WORKLOAD SECTION

For each job/equipment listed on the following pages, you will be asked to provide answers to the following questions.

- A. How often in the last 6 months (or in a typical 6 month period), did you work on the listed job/equipment?

Make your choice on the answer page by checking in the column that best represents the number of times you worked on the listed job or equipment. E.g., If you did the job 8 times in a typical 6 month period, put an "X" in the column with the heading "6-10" as shown below:

HOW OFTEN IN 6 MONTHS?				
1	2	3-5	6-10	>10
			X	

- B. Of the times you worked on this job/equipment, how many times were you involved in troubleshooting, removal/replacement, and repairing?

Write in the NUMBER OF TIMES you performed troubleshooting, removal/replacement or repair for each job/equipment. Write in "N/A" where the type of work does not apply to the job/equipment.

E.G., For the work you did on this job/equipment 8 times above, if you troubleshoot 3 times, remove and/or replace all 8 times and had to do a repair once, write in the numbers as follows:

OF THESE, NUMBER INVOLVING...		
T-SHOOT	R/R	REPAIR
3	8	1

- C. On average, each time you performed troubleshooting, removal/replacement, or repair for this job/equipment, how much time did you spend?

Enter the number of hours and minutes (or just minutes, if less than one hour is spent).

ON AVERAGE, HOW LONG EACH TIME?		
T-SHOOT	R/R	REPAIR
00:30	01:30	04:00

REMEMBER WHEN ANSWERING TASK-SPECIFIC ITEMS:

- Answer about work in a TYPICAL 6 MONTH PERIOD (peace-time operations).
 - COUNT ONLY work that you would see (as an individual) in a typical 6 month period (not everything that comes into the unit).
 - CROSS OFF job/equipment you would not expect to encounter in a typical 6 month period.
- DO NOT include scheduled maintenance inspections.

	HOW OFTEN IN LAST 6 MONTHS?					OF THESE NUMBER INVOLVING...			ON AVERAGE HOW LONG EACH TIME?		
	1	2	3-5	6-10	> 10	T-SHOOT	R/R	REPAIR	T-SHOOT	R/R	REPAIR
MOS 67Y-AH-1 AIRCRAFT REPAIRER											
Group 1: AIRFRAME											
Fuselage skin									:	:	:
Sheet metal for structural members									:	:	:
Honeycomb panels									:	:	:
Transmission mounts									:	:	:
Transmission mount dampers									:	:	:
Windshield									:	:	:
Window assembly									:	:	:
Pilot/gunner door assemblies									:	:	:
Pilot/gunner seat installation									:	:	:
Striker assembly									:	:	:
Soundproofing blanket assembly									:	:	:
Engine deck assembly									:	:	:
Mount assembly									:	:	:
Cowl assemblies									:	:	:
Firewall assembly									:	:	:
Heatshield assembly									:	:	:
Support arms (brace rods, tripod, and bipod)									:	:	:
Pillow block assembly									:	:	:
Wire strike cutters									:	:	:
Wire strike deflector (nose)									:	:	:
Deflector assembly (canopy)									:	:	:
Nose deflector									:	:	:
Tailboom assembly									:	:	:

WORK DISTRIBUTION ACROSS DIFFERENT AIRCRAFT SECTION

[NOTE: This section appeared in the Maintainer
Surveys for MOSSs 68F, 68G, 68H, and 68NLQR
(Avionics) only.]

DISTRIBUTION OF WORK ACROSS AIRCRAFT TYPES

For the following items, you will be asked to distribute your maintenance time (unscheduled maintenance only) among the various aircraft you work on in a typical 6 month period.

NOTE: ANSWER CATEGORIES FOR THESE QUESTIONS ARE DIFFERENT from the previous section you've just completed. Review the categories carefully and choose the lettered category which best represents your experience.

1. Please indicate in the grid at the bottom of the page, HOW OFTEN, on average, you work on each aircraft indicated there. Mark your responses in the "Item 1" column, choosing from the following:

- A. Less than 1 day/month
- B. 1-2 days/month
- C. 1 day/week (3-6 days/month)
- D. 2 days/week (7-10 days/month)
- E. 3 days/week (11-14 days/month)
- F. 4 days/week (almost every work day)
- G. 5 days/week (every work day)

2. On an average day when you work on this aircraft, about HOW MANY HOURS do you spend? Mark your response in the "Item 2" column, choosing from the following:

- A. Less than 1 hour
- B. About 1 hour
- C. 1 1/2 hours
- D. 2 hours
- E. 3 hours
- F. 4 hours
- G. 5 hours
- H. 6 hours
- I. 7 hours
- J. 8 hours or more

	HOW OFTEN (Item 1)	AVG. HOURS (Item 2)
AH-1		
AH-64		
UH-1		
UH-60		
CH-47D		
OH-58A/C		
OH-58D		

GENERAL MOS-RELATED WORK SECTION

WHEN YOU REACH THIS PAGE, PLEASE STOP AND RAISE YOUR HAND.

THE SURVEY ADMINISTRATORS WILL GIVE THE NECESSARY
INSTRUCTIONS TO COMPLETE THIS SECTION.

[NOTE: Surveys for the 67 series MOSs included both the General MOS-Related Work sheets (aircraft specific and subsystem specific lists). Surveys for the 68 series MOSs only included the subsystem specific sheet.]

GENERAL MOS-RELATED WORK SECTION

Some MOS's work is closely related to the work of other MOS's (e.g., electrical (68F) and armament electrical systems (68J), or powertrain (68D) and flight control systems (67 series)).

For the following component areas (MOS 68 series) and/or different aircraft (MOS 67 series), you will be asked to provide answers to the questions below.

NOTE: ANSWER CATEGORIES FOR THESE QUESTIONS ARE DIFFERENT from the previous section you've just completed. Review the categories carefully and choose the letter in quotes which best represents your experience.

- A. HOW OFTEN IN THE LAST 6 MONTHS (OR IN A TYPICAL 6 MONTH PERIOD), DID YOU WORK ON THE LISTED AIRCRAFT?

Make your choice on the answer page by checking in the column that best represents the number of times you worked on the listed job or equipment.

If you did the task:

Less than 1 day/month .	put a check in column "A"
1-2 days/month	put a check in column "B"
1 day/week	put a check in column "C"
2 days/week	put a check in column "D"
3-5 days/week	put a check in column "E"

- B. OUT OF 10 TIMES WHEN YOU WORK ON THE LISTED AIRCRAFT, HOW MANY TIMES ARE YOU INVOLVED IN TROUBLESHOOTING, REMOVAL/REPLACEMENT, AND REPAIRING?

- C. ON AVERAGE, EACH TIME YOU PERFORMED TROUBLESHOOTING, REMOVAL/REPLACEMENT, OR REPAIR ON THE LISTED AIRCRAFT, HOW MUCH TIME DID YOU SPEND?

Enter the number of hours and minutes (or just minutes, if less than one hour is spent).

	HOW OFTEN IN LAST 6 MONTHS?					FOR EVERY 10 TIMES, NUMBER INVOLVING			ON AVERAGE HOW LONG EACH TIME?		
	A	B	C	D	E	T-SHOOT	R/R	REPAIR	T-SHOOT	R/R	REPAIR
<u>AH-64 APACHE</u>											
SCHEDULED MAINTENANCE									:	:	:
UNSCHEDULED MAINTENANCE									:	:	:
									:	:	:
<u>UH-60 BLACKHAWK</u>											
SCHEDULED MAINTENANCE									:	:	:
UNSCHEDULED MAINTENANCE									:	:	:
									:	:	:
<u>CH-47D CHINOOK</u>											
SCHEDULED MAINTENANCE									:	:	:
UNSCHEDULED MAINTENANCE									:	:	:
									:	:	:
<u>AH-1 COBRA</u>											
SCHEDULED MAINTENANCE									:	:	:
UNSCHEDULED MAINTENANCE									:	:	:
									:	:	:
<u>UH-1 HUEY</u>											
SCHEDULED MAINTENANCE									:	:	:
UNSCHEDULED MAINTENANCE									:	:	:
									:	:	:
<u>OH-58A/C SCOUT</u>											
SCHEDULED MAINTENANCE									:	:	:
UNSCHEDULED MAINTENANCE									:	:	:
									:	:	:
<u>OH-58D SCOUT</u>											
SCHEDULED MAINTENANCE									:	:	:
UNSCHEDULED MAINTENANCE									:	:	:
									:	:	:

	HOW OFTEN IN LAST 6 MONTHS?					FOR EVERY 10 TIMES, NUMBER INVOLVING			ON AVERAGE, HOW LONG EACH TIME?		
	A	B	C	D	E	T-SHOOT	R/R	REPAIR	T-SHOOT	R/R	REPAIR
GROUP 1: AIRFRAME									:	:	:
									:	:	:
GROUP 2: LANDING GEAR									:	:	:
									:	:	:
GROUP 3: POWER PLANT									:	:	:
									:	:	:
GROUP 4: ROTOR SYSTEM									:	:	:
									:	:	:
GROUP 5: DRIVE SYSTEM									:	:	:
									:	:	:
GROUP 6: PNEUDRAULICS/HYDRAULICS									:	:	:
									:	:	:
GROUP 7: ELECTRICAL SYSTEM									:	:	:
									:	:	:
GROUP 7b: INSTRUMENTS									:	:	:
									:	:	:
GROUP 8: FUEL SYSTEM									:	:	:
									:	:	:
GROUP 9: FLIGHT CONTROL SYSTEM									:	:	:
									:	:	:
GROUP 10: UTILITY SYS/ENVIRON CNTRL									:	:	:
									:	:	:
GROUP 11: AUX POWER UNIT SYSTEM									:	:	:
									:	:	:
GROUP 12: A S E									:	:	:
									:	:	:
GROUP 13: AVIONICS									:	:	:
									:	:	:
GROUP 14: WEAPONS DELIVERY									:	:	:
									:	:	:
GROUP 15: FIRE CONTROL/TARGET ACQ									:	:	:
									:	:	:
GROUP 16: OTHER									:	:	:
(Please specify):									:	:	:
									:	:	:
(Please specify):									:	:	:
									:	:	:

Appendix B
SUPERVISOR SURVEY INSTRUMENT

Found in the following pages is the Supervisor Survey questionnaire as it was used in the field. The only section that does not appear in its entirety is the MOS task-specific workload section. Here the reader will find a single page sample that shows the format used. The complete task lists are found in Appendix C.

BACKGROUND SECTION

1. What is your primary MOS (e.g., 68B20, 67N10)? _____
2. What is your duty MOS? _____
3. When did you complete AIT/Transition Training for your current duty MOS?
_____/____ (MM/YY)
4. What unit are you currently assigned to (e.g., E CO 123rd AVN), and when did you arrive in this unit?

(Unit name) Date arrived? ____/____
(MM/YY)
5. What unit, if any, were you assigned to just prior to your current unit, and for what duration?

(Unit name) From? ____/____ To? ____/____
(MM/YY) (MM/YY)
6. What level of maintenance unit are you assigned to? (Circle One)
AVIM (Divisional) 1
AVIM (Non-Divisional) 2
AVUM 3
7. Is there ONE particular maintenance team to which you are primarily assigned (e.g., AVIM contact team, phase maintenance team, etc.)?
NO 1
YES 2
If YES, please specify: _____
8. Did you cross-train into the aviation maintenance career area? (Circle one)
NO 1
YES 2
- 8a. If YES, please specify what MOS you worked in before cross-training and for how many years.
MOS: _____ How Long? _____ yrs
9. Do you have an ASI (Additional Skill Identifier) (e.g., X1, W5)?
Please Specify: _____

10. How many years of active military service in the Army do you have?
(Circle one)

Less than 3 months	1	2-4 years	5
3-6 months	2	4-6 years	6
7-11 months	3	7 years or more	7
12-24 months	4		

11. What is your current rank (paygrade)? (Circle one)

PV1 (E1)	1	SSG (E6)	6
PV2 (E2)	2	SFC (E7)	7
PFC (E3)	3	MSG/1SG (E8)	8
SPC/CPL (E4)	4	SGM/CSM (E9)	9
SGT (E5)	5		

12. How long have you worked in the aviation maintenance field?
(Circle one)

Less than 3 months	1	2-4 years	5
3-6 months	2	4-6 years	6
7-11 months	3	7 years or more	7
12-24 months	4		

13. How long have you been assigned to your current duty position?
(Circle one)

Less than 3 months	1	2-4 years	5
3-6 months	2	4-6 years	6
7-11 months	3	7 years or more	7
12-24 months	4		

14. What duty position title best describes the work you are currently doing? (E.g., senior mechanic, Powertrain repairer, electrical repair technical inspector, Safety NCO, AH-64 repair supervisor, etc.)

Please Specify: _____

15. How many hours are you on duty (maintenance and non-maintenance) on an average week?

_____ hrs

- 15a. Of the hours indicated above, how many hours do you spend working on each of the following?

DIRECT MAINTENANCE (NOT including completing forms, locating parts, administrative duty) _____ hrs

SUPERVISION OF OTHERS PERFORMING DIRECT MAINTENANCE _____ hrs

OTHER MAINTENANCE-RELATED DUTIES (including completing forms, locating parts, administration, and supervision of these duties) _____ hrs

NON-MAINTENANCE DUTIES _____ hrs

(Combined Total should be the same as Item 15 above)

Please Specify Non-maintenance duties below:

16. Of every 20 hours you spend on maintenance, about how many hours do you spend on each of the following?

AVUM Level Maintenance _____ hrs

AVIM Level Maintenance _____ hrs

(Combined Total should be 20 hours)

17. Roughly what fraction of your day-to-day direct maintenance tasks do you currently perform independently (without direct "over the shoulder" supervision)? (Circle one)

Very little or none 1

Some 2

About half 3

Most 4

Almost all or all 5

18. How many people do you directly supervise in each of the following paygrades?

E1 _____ E4 _____ E7 _____
E2 _____ E5 _____ E8 _____
E3 _____ E6 _____ E9 _____ None Supervised _____

- 18a. If you directly supervise others, what MOS's do you supervise?
(Circle all that apply)

67 Series: 67N 67R 67S 67T 67U 67V 67Y
68 Series: 68B 68D 68F 68G 68H 68J 68L 68N 68Q 68R

19. What is your sex? (Circle one)

Male 1 Female 2

20. How old were you on your last birthday? _____ yrs

21. What is your highest level of education? (Circle one)

Elementary school (grades 1-8) 1
Some high school or some technical training 2
GED (General Educational Development) 3
Graduated high school (received regular diploma)... 4
2 year or less of college (no degree) 5
Two-year associate degree (AA) 6
More than 2 year off college (no degree) 7
Four-year college degree (BA, BS) 8
Some gradate school 9

MOS TASK-SPECIFIC TRAIN-UP SECTION

WHEN YOU REACH THIS PAGE, PLEASE STOP AND RAISE YOUR HAND.

**THE SURVEY ADMINISTRATORS WILL GIVE THE NECESSARY
INSTRUCTIONS TO COMPLETE THIS SECTION.**

MOS TASK-SPECIFIC TRAIN-UP SECTION

For each job/equipment listed on the following pages, you will be asked to provide answers to the following questions.

1. How many MONTHS after arrival at the unit could a typical new AIT graduate start to be trained on this task? (Begin working WITH supervision.)
2. After his first exposure to this task, how many MONTHS would you typically expect to pass before he is able to perform it independently?
3. How many EXPOSURES to this task are typically needed before an individual is able to perform it independently?

* * * * *

REMEMBER WHEN ANSWERING:

- o CROSS OFF TASKS that do not typically occur under your supervision at least twice in a typical 6 months period.
- o Answer about a typical 6 month period (peace-time operations).

[illegible]

GENERAL TRAIN-UP TIME SECTION

GENERAL TRAINUP TIME FOR MOS AREA

As a maintainer "trains up" in his MOS area, he becomes capable of performing more maintenance tasks independently (with minimal "over the shoulder" supervision). Drawing on your maintenance and supervision experience, please answer the following for the MOS area of your survey:

About what fraction of day-to-day direct maintenance tasks would you expect an AIT graduate to be able to perform INDEPENDENTLY after having worked in the field unit for 3 months, 6 months, etc.? Provide your answers in the grids below by circling the single most appropriate response for each level of field experience.

1. First, consider maintainers of AVERAGE ability in your MOS area:

Fraction of day-to-day direct maintenance tasks
capable of performing INDEPENDENTLY

	(a) Very Little	(b) Some	(c) About Half	(d) Most	(e) All, or almost all
Months in Field					
0	a	b	c	d	e
3	a	b	c	d	e
6	a	b	c	d	e
9	a	b	c	d	e
12	a	b	c	d	e
18	a	b	c	d	e
24	a	b	c	d	e
36	a	b	c	d	e

- continued on the next page -

2. Next, consider a "fast burner" (well above average ability).

Fraction of day-to-day direct maintenance tasks
capable of performing INDEPENDENTLY

	(a) Very Little	(b) Some	(c) About Half	(d) Most	(e) All, or almost all
Months in Field					
0	a	b	c	d	e
3	a	b	c	d	e
6	a	b	c	d	e
9	a	b	c	d	e
12	a	b	c	d	e
18	a	b	c	d	e
24	a	b	c	d	e
36	a	b	c	d	e

3. Finally, consider a "slow learner" (well below average ability).

Fraction of day-to-day direct maintenance tasks
capable of performing INDEPENDENTLY

	(a) Very Little	(b) Some	(c) About Half	(d) Most	(e) All, or almost all
Months in Field					
0	a	b	c	d	e
3	a	b	c	d	e
6	a	b	c	d	e
9	a	b	c	d	e
12	a	b	c	d	e
18	a	b	c	d	e
24	a	b	c	d	e
36	a	b	c	d	e

MOS CONSOLIDATION SECTION

MOS CONSOLIDATION SECTION

The Army is considering reducing the number of MOSs for first term helicopter maintainers, making these personnel less specialized than at present. Their training would include a broader range of tasks at the basic level. This would mean that some of the current MOSs would be combined with others in the first term.

Some reasons why one MOS might be combined with another include:

- o similar skills used in each MOS
- o frequent need for both MOSs to work on same jobs
- o individuals could achieve at least basic proficiency in both MOS areas

1. What MOSs do you think could be grouped together with your own MOS, if such a consolidation were to take place? Underline your own MOS first. Then circle as few or as many other MOSs as you think can reasonably be combined with your own MOS.

68 SERIES MOSs:

68B Powerplant Repr
68D Powertrain Repr
68F Electrical Repr
68G Structural Repr
68H Pneudraulics Repr
68J Armament/Missile Sys Repr
68L Avionic Comm Equip Repr
68N General Avionics Repr
68Q Avionic Flight Control Repr
68R Avionic Navigation/Radar Repr

67 SERIES MOSs:

67N UH-1 Helicopter Repr
67R AH-64 Helicopter Repr
67S OH-58D Helicopter Repr
67T UH-60 Helicopter Repr
67U CH-47D Helicopter Repr
67V OH-58A/C Helicopter Repr
67Y AH-1 Helicopter Repr

2. What are the reasons for your choices? Please specify below:

COMPARATIVE JOB PERFORMANCE SECTION

WHEN YOU REACH THIS PAGE, PLEASE STOP AND RAISE YOUR HAND.

THE SURVEY ADMINISTRATORS WILL GIVE THE NECESSARY
ANSWER SHEETS AND INSTRUCTIONS TO COMPLETE THIS SECTION.

COMPARATIVE JOB PERFORMANCE SECTION

Answer the following questions based on the maintainers you currently supervise, or have supervised in the recent past. You will need to provide separate answers for removal/replacement, troubleshooting and repairing actions, as indicated.

Think about an average maintainer with 24 months of experience in a unit since graduating from AIT. Suppose that he spends one hour performing removal/replacement, troubleshooting or repair for the equipment/jobs in this group.

- A. About how many minutes of active supervision does he need to ensure that the work is done properly? (Fill in the minutes in the line for 24 months.)
- B. Based on your supervisory experience, about how long would it take an average maintainer with 18 months experience to perform the same amount of work on these jobs that the maintainer with 24 months experience performs in one hour?
- C. How many minutes of active supervision would he need to ensure that the work is done properly?
- D. Repeat this procedure for maintainers with 12, 6, and 3 months experience, until you have filled in all of the boxes.

Note: Based on your supervisory experience, if a maintainer of a given experience level does not work on these jobs, write "N/A" in the "TIME" box.

COMPARATIVE JOB PERFORMANCE RESPONSE SHEET

MOS: _____

GROUP NO.: _____

	REMOVE/REPLACE	
	TIME	SUPVN
	HRS : MIN	MIN
3 MONTHS	:	
6 MONTHS	:	
12 MONTHS	:	
18 MONTHS	:	
24 MONTHS	1 : 00	

	TROUBLESHOOT	
	TIME	SUPVN
	HRS : MIN	MIN
3 MONTHS	:	
6 MONTHS	:	
12 MONTHS	:	
18 MONTHS	:	
24 MONTHS	1 : 00	

	REPAIR	
	TIME	SUPVN
	HRS : MIN	MIN
3 MONTHS	:	
6 MONTHS	:	
12 MONTHS	:	
18 MONTHS	:	
24 MONTHS	1 : 00	

GROUP NO.: _____

	REMOVE/REPLACE	
	TIME	SUPVN
	HRS : MIN	MIN
3 MONTHS	:	
6 MONTHS	:	
12 MONTHS	:	
18 MONTHS	:	
24 MONTHS	1 : 00	

	TROUBLESHOOT	
	TIME	SUPVN
	HRS : MIN	MIN
3 MONTHS	:	
6 MONTHS	:	
12 MONTHS	:	
18 MONTHS	:	
24 MONTHS	1 : 00	

	REPAIR	
	TIME	SUPVN
	HRS : MIN	MIN
3 MONTHS	:	
6 MONTHS	:	
12 MONTHS	:	
18 MONTHS	:	
24 MONTHS	1 : 00	

GROUP NO.: _____

	REMOVE/REPLACE	
	TIME	SUPVN
	HRS : MIN	MIN
3 MONTHS	:	
6 MONTHS	:	
12 MONTHS	:	
18 MONTHS	:	
24 MONTHS	1 : 00	

	TROUBLESHOOT	
	TIME	SUPVN
	HRS : MIN	MIN
3 MONTHS	:	
6 MONTHS	:	
12 MONTHS	:	
18 MONTHS	:	
24 MONTHS	1 : 00	

	REPAIR	
	TIME	SUPVN
	HRS : MIN	MIN
3 MONTHS	:	
6 MONTHS	:	
12 MONTHS	:	
18 MONTHS	:	
24 MONTHS	1 : 00	

Appendix C
MOS SPECIFIC TASK LISTS

MOS 67N-UH-1 UTILITY HELICOPTER REPAIRER

GROUP 1: AIRFRAME

Tail boom assembly
Fuselage skin
Sheet metal for structural members
Honeycomb panels
Cabin nose assembly
Crew door assembly
Cabin roof assembly
Hinged panel assembly
Pilot/Co-pilot seat assembly
Passenger seat assembly
Soundproofing blanket assembly
Equipment door assembly
Inspection doors
Left and right engine deck assembly
Center engine deck assembly
Mount assembly
Cowl assemblies
Baffle assembly
Firewall assembly
Heatshield assembly
Engine mount support arms (brace rods, tripod, and bi-pod)
Pillow block assembly

GROUP 2: ALIGHTING GEAR

Cross tube assembly
Skid installation
Tail skid installation
Ski isolation damper (UH-1H/V, EH-1H)
Float gear (UH-1C/M)

GROUP 3: POWERPLANT

Engine (complete assembly)
Particle separator
Tail pipe
Heat suppressor
Linear actuator
Power lever controls
Droop compensator
Engine oil tank
Hoses, fittings, and tubing

Engine oil cooler
Turbine blower
Engine chip detector
Inlet filter assembly
Breakaway valves

GROUP 4: PROPELLERS/ROTOR SYSTEMS

External components, pylon assembly
Pylon dynamic stops (UH-1C/M)
Stabilizer bar assembly
Main rotor hub and blade assembly
Drag brace assembly
Grip assembly
Oil reservoirs and sight glasses
Pitch horn assembly
Trunnion assembly
Blade retention bolt assembly
Pillow block assembly
Yoke assembly
Plate assembly
Main rotor shield assembly
Main rotor tension strap assembly
Main rotor sand deflector (UH-1C/M)
Scissors and sleeve assembly
Scissors link assembly
Scissors hub and blade assembly
Collective sleeve
Swashplate and support assembly
Stabilizer damper assembly
Tail rotor installation
Tail rotor link assembly
Tail rotor crosshead
Tail rotor blade assembly
Tail rotor hub assembly

GROUP 5: DRIVE TRAIN SYSTEM

Mast spring
Mast support assembly
Transmission assembly
Pressure relief valve
Lines, fittings, and screens
Oil jets
Filter assembly (primary)
Input drive quill
Offset quill
Hydraulic pump and tachometer drive quill
Tail rotor quill
Sight gages
Chip detector
Oil pump assembly
Main drive shaft (engine to transmission bell)
Main drive shaft (engine to transmission kaflex)
Oil cooler
External oil filter

Manifold assembly
Tail rotor drive shaft
Tail rotor drive shaft hanger assembly
Tail rotor 42-degree and 90-degree gearbox

GROUP 6: HYDRAULIC AND PNEUMATIC SYSTEMS

Hydraulic and pneumatic systems
Main servocylinder assembly
Connecting link, clevis fittings, plugs
Hoses, tubing, and fittings
Pressure switch
Directional valve
Filter assembly
Check valve
Safety relief valve
Irreversible valve
Hydraulic fluid tank
Axial piston pump
Coupling halves
Tail rotor servocylinder

GROUP 7: INSTRUMENT SYSTEMS

Instrument panel
Glareshield
Clock
Free air temperature gage
Volt load and amp meter
Fuel quantity indicator and amplifier
Fuel quantity transmitter
Vertical velocity indicator
Stand-by compass
Airspeed indicator
Altimeter indicator
Attitude indicator
Turn and slip indicator
Pitot system
Dual tachometer
Exhaust gas temperature indicator
Thermocouple lead spool resistor
Oil temperature indicator
Oil pressure indicator and transmitter
Fuel pressure indicator and transmitter
Torquemeter and transmitter
Tachometer generators
Gas producer tachometer
Temperature bulbs
Tank sensors, probes and units

GROUP 8: ELECTRICAL SYSTEMS

Wiring
Relays, rheostats, switches, circuit breakers, plugs, leads, connectors,
conduits, receptacles, shunts, and shock mounts
Battery

Regulator
Main generator
Starter generator
Inverters
AC transformer
Navigational instrument, interior cabin, and anti-collision lights
Flasher unit
Search light assembly
Landing light assembly
Control panels
Caution panels
RPM warning control box
Chip detector system
Elector-mechanical linear actuator (EH-1H)
30 KiloVoltAmp alternator (EH-1H)

GROUP 9: FUEL SYSTEM

Fuel systems
Submerged fuel booster pump
Hoses and tubing
Adapters and fittings
Safety relief valve
Drain cock
Check valve
Filter assembly
Gate valve
Manifold valve
Pressure transmitter
Crossover assemblies
Cap and adapter assembly
Fuel probe transmitter
Float switch assembly
Main fuel tanks, both crashworthy and non-crashworthy
Cross fitting assembly
Ejector pump assembly
Flapper valve
Flapper valve plates
Sump assembly
Auxiliary internal tank assembly, both crashworthy and non-crashworthy
Auxiliary external tank assembly
Closed circuit refuel receptacle

GROUP 10: FLIGHT CONTROLS

Main rotor control tubes, links, and rod ends
Flight control bearings
Cyclic control system:
 Cyclic control stick
 Cyclic control tube and lever assembly
 Cyclic control magnetic brake
 Cyclic control force gradient
 Cyclic control mixing lever assembly
 Cyclic control tubes, links, and clevises
 Cyclic control bellcranks, levers, and supports

Collective control system:

- Jackshift
- Control assembly
- Pilot's stick
- Co-pilot's stick
- Control tubes
- Bellcranks, levers, and supports

Elevator control system:

- Control tubes
- Bellcranks, levers, and supports

Tail rotor control system:

- Control cables
- Adjustor assembly
- Control pulleys
- Control quadrant
- Rod and quill
- Force gradient
- Control tubes
- Bellcranks, levers, and supports
- Control chain (roller type)

GROUP 11: UTILITY SYSTEMS

- Windshield wiper system
- Fire detection system

GROUP 12: ENVIRONMENTAL CONTROL SYSTEMS

Bleed air distribution system:

- Hoses, tubing, ducts
- Registers and nozzles
- Heating selector valve assembly
- Thermostatic switch
- Mixing valve assembly
- Valve

Auxiliary exhaust heating system (Muff):

- Muff heat exchanger
- Muff hoses, tubing, ducts
- Muff blower unit
- Muff mixing valve
- Muff plenum assembly
- Muff overheat switch

Combustion auxiliary heater system (UH-1C/M)

Auxiliary heater system:

- Hoses, tubing, and ducts (UH-1C/M)
- Thermostatic switch (UH-1C/M)
- Temperature element (UH-1C/M)
- Ignition assembly (UH-1C/M)
- Heater (UH-1C/M)
- Blower assembly (UH-1C/M)
- Control box assembly (UH-1C/M)

GROUP 13: HOISTS AND WINCHES

Rescue hoist assembly:

- Post and locknut
- Cable
- Guillotine and support
- Guide tube
- Boom
- Trigger assembly
- Side plates and roller
- Limit switches
- Overload sensing relay
- Hook and bumper assembly
- Adapters
- Power cables
- Control box
- Control pendant
- Drive unit
- Cable storage drum
- Rubber pressure roller
- Actuator and lever
- Lower post support

Cargo suspension assembly:

- Release cables
- Pedal assembly
- Cargo hook

High performance rescue hoist Assembly (UH-1H/V, EH-1H):

- Winch assembly (UH-1H/V, EH-1H)
- Limit switch drive assembly (UH-1H/V, EH-1H)
- Switches and connector (UH-1H/V, EH-1H)
- Motor assembly (UH-1H/V, EH-1H)
- Brake assembly (UH-1H/V, EH-1H)
- Chain (UH-1H/V, EH-1H)
- Cable hook assembly (UH-1H/V, EH-1H)
- Boom assembly (UH-1H/V, EH-1H)
- Up limit actuator (UH-1H/V, EH-1H)
- Cable assembly (UH-1H/V, EH-1H)
- Full up limit switches (UH-1H/V, EH-1H)

Post structure/boom position actuator assembly (UH-1H/V, EH-1H):

- Stanchion (UH-1H/V, EH-1H)
- Mechanical stop assembly (UH-1H/V, EH-1H)
- Rotary actuator assembly (UH-1H/V, EH-1H)
- Reaction arm assembly (UH-1H/V, EH-1H)
- Limit switches (UH-1H/V, EH-1H)
- Upper stanchion (UH-1H/V, EH-1H)

High performance rescue hoist control panel (UH-1H/V, EH-1H):

- Cables (UH-1H/V, EH-1H)
- Lamps (UH-1H/V, EH-1H)
- Control pendant (UH-1H/V, EH-1H)
- Indicator lamp (UH-1H/V, EH-1H)

Post structure/boom position actuator assembly (UH-1H/V, EH-1H):

- Motor (UH-1H/V, EH-1H)
- Inertia dump assembly (UH-1H/V, EH-1H)

GROUP 14: MISSION EQUIPMENT

Smoke generator subsystem (UH-1H/V, EH-1H)
Blackout curtain assembly
Paratroop static line
External stores support assembly
Heat suppression (IR) (UH-1H/V, EH-1H)
Litter racks (UH-1V)
External stores pylon assembly
M60C armament subsystem
External stores rack
M56 armament subsystem (UH-1H/V, EH-1H)
M56 armament subsystem external manual jettison (UH-1H/V, EH-1H)
M56 armament subsystem strut tube assembly (UH-1H/V, EH-1H)
M56 armament subsystem damper assembly (UH-1H/V, EH-1H)
M56 armament subsystem control panel dispenser (UH-1H/V, EH-1H)
M23 armament subsystem (UH-1H/V, EH-1H)
M23 armament subsystem mount assembly (UH-1H/V, EH-1H)
Blood bottle hooks (UH-1V)
M130 armament subsystem (EH-1H/X)
M5 armament subsystem (UH-1C/M)
M21 armament subsystem (UH-1C/M)
M3 armament subsystem (UH-1C/M)
M6 armament subsystem (UH-1C/M)
M22 armament subsystem (UH-1C/M)
M16 armament subsystem (UH-1C/M)
M3 personal detector armament system (UH-1C/M)

GROUP 15: EMERGENCY EQUIPMENT

First aid kit
Fire extinguisher
Fire extinguisher bracket
Jettison system, internal, external stores

MOS 67R-AH-64 ATTACK HELICOPTER REPAIRER

GROUP 1: AIRFRAME (FORWARD FUSELAGE)

Bracket assembly
Access door
Canopy lock
Clip assembly
Ammo fairing assembly
Airframe step assembly
Electrical clip support
Fan support assembly
Angle brackets
Airframe door
Access covers
Transition duct
Glareshield assembly
Curtain tray assembly
Glareshield extension assembly
Scuff plate assembly
Seat foot guard
Door cable release strut
Barrier assembly
Seat assembly
Map compartment
Pass thru tray
Main rotor mast support
Rotor support strut assembly
Rotor support assembly
Main rotor support mast base assembly
Seat fitting assembly
Web assembly
Shelf assembly
Tray assembly
Rod end clevis

GROUP 2: AIRFRAME (CENTER FUSELAGE)

Engine support assembly
Cable bracket assembly
Fuel drain pan assembly
Fuel cell panel assembly
Fuselage support assembly
Airframe fuselage fairing
Shock strut fairing
Latch hook assembly
Walkway seal assembly
Nacelle post assembly
Support nacelle
Airframe wing
Fuselage panel
Edge wing trailing
Access covers
Engine nacelle assembly

Water door assembly
Door stop
Connecting link
Level jack assembly
Strut assembly
Engine nacelle fairing
Fuselage fairing
Transmission support assembly
Fairing rotor
Longerons
Doghouse fairing assembly
Radar cover assembly
Radar plate assembly
Catwalk clip assembly
Treadway panel assembly
Windshield panel

GROUP 3: AIRFRAME (AFT FUSELAGE)

Instrument panel assembly
Console panel assembly
Cockpit panel sub-assembly
Structural plate
Indicator panel
Stabilizer bracket assembly
Stabilizer fairing
Stabilizer assembly
Pivot fitting assembly
Vertical stabilizer
Stowage door assembly
Stowage closure assembly

GROUP 4: LANDING GEAR

Landing gear assembly
Trailing arm assembly
Shock struts assembly
Rod end assembly
Wheel assembly (main landing gear)
Shock struts (main landing gear)
Shock struts (tail landing gear)
Tailgear arm assembly
Landing gear fork
Tail wheel assembly
Brake system
Cylinder assembly
Brake control valve
Direct rotary valve
Brake assembly
Hoses and tubing-brake system
Parking brake valve
Transfer valve

GROUP 5: POWERPLANT SYSTEMS

Powerplant installation
Engine cooling louver assembly
Engine (buildup assembly)
Tail pipe
Engine(s) power available spindle system
Radiation shields
Primary exhaust nozzles
Engine cooling louver actuators
Cooling doors
Anti-icing valve
Air inlet assembly
Secondary exhaust nozzles
Inlet particle separators (IPS)
Wiring harness
Engine speed control unit
No. 1 engine load demand spindle forward cable assembly
Quadrant assembly
Power lever assembly
Air starter engine
Flow regulating valve

GROUP 6: ROTOR SYSTEMS

Rotary wing head
Rotor hub sub-assembly
Link assemblies
Shoe assembly
Rotary wing blade
Swashplate assembly
Rotary wing blade static discharger
Rotary wing blade balance weight
Tail rotor head assembly
Fork assembly
Rotary rudder blade
Rotary rudder blade balance weight

GROUP 7: DRIVETRAIN (POWERTRAIN) SYSTEM

Drive system
Drive shaft
Tail rotor shaft assembly
Transmission shaft
Support assembly
Coupling assembly
Anti-flail assembly
Hanger assembly
Main transmission
Oil filter
Main drive plate
Heat exchanger
Data mast assembly
Main transmission standpipe assembly
Quick attach assembly (No. 1 & 2 generator)
Main transmission generator spline adapter

Main transmission APU input seal
Mast base shield and retainer
Intermediate gearbox
Tail rotor gearbox
Tail rotor gearbox cover

GROUP 8: HYDRAULIC SYSTEM

Hydraulic system installation
Hydraulic pump
Servocylinder
Manifold assembly
Self retaining bolt
Hydraulic manifold
Hydraulic accumulator
Heat exchanger
Eductor assembly
Duct assembly
GSE panel assembly
RAM hydraulic pump
Arm assembly
Bracket assembly
Panel assembly
Tube assemblies
Primary manifold drain tube
Pressurized air system
Valves
Gages
Hydraulic/nitrogen accumulator
Air separator
Rotor compressor seal plate

GROUP 9: INSTRUMENT SYSTEMS

Instrument tray assembly
Pilot/CPG stabilator position indicator
Horizontal indicator
Digital indicator
Aircraft clock
Pressure altimeter
Exhaust temperature indicator
Torquemeter indicator
Electrical indicator
Pressure gage dial
Liquid quantity indicator
Signal data converter
Static port assembly
Drain cock

GROUP 10: ELECTRICAL SYSTEMS

Navigational light
Actuator assembly
Transmitters
Transducers

GROUP 11: FUEL SYSTEM

Fuel system installation
Fuel-defuel valve
Fuel servicing manifold
Shutoff valve
Solenoid valve
Valve bracket assembly
Tube assembly
Submerged pump
Pump bracket assembly
Fuel transfer valve
Pressure relief valve
Gas vent valve
Fuel cell tube vent
Aircraft fuel tank
Aft fuel cell assembly
Fuel cell cover
APU shutoff valve
Booster fuel pump
Valve support assembly
Nitrogen inerting assembly
Air heat exchanger filter assembly and housing
Fuel panel assembly

GROUP 12: FLIGHT CONTROLS

Flight controls installation
Aircraft control stick
Control stick spring assembly
Control stick support assembly
Rigid connecting link
Cyclic control stick
Push-pull rod assembly
SPAD assembly
Bellcrank assembly
Magnetic brake assembly
Pilot and copilot pedal
Push rod guide
Tail rotor support assembly
Drive link assembly
Tail rotor swashplate assembly
Protective cover
Panel assemblies
Flight control computer
Linear variable differential transducer (LVDT)
Horizontal stabilator
Collective flight controls
Lateral flight controls
Longitudinal flight controls
Tube assemblies
Housing assemblies
Cylinder assemblies
Support assembly
Arm assembly
Cyclic support assembly

Yoke assembly
Pilot and copilot pedal support crank
Spring assembly

GROUP 13: UTILITY SYSTEMS

Windshield wiper
Windshield wiper assembly
Signal processor unit
Fire extinguisher thermal indicator
Fire extinguisher container
Fire extinguisher assembly
Canopy jettison system
Blade de-ice system controller

GROUP 14: ENVIRONMENTAL SYSTEMS

Vaneaxial fan
Duct assembly
Environmental control unit assembly
Aircraft turbine (environmental control)
Temperature control
Duct assemblies
AUX CPG panel assembly

GROUP 15: AUXILIARY POWER UNIT (APU)

APU (gas turbine engine)
APU enclosure
PTO clutch assembly
APU controller unit
APU fuel filter
APU hydraulic starter
APU wiring harness
APU aft support strut & rod end
APU fuel supply hose assembly
APU drain tube
APU gearbox oil filler cap

GROUP 16: MISSION EQUIPMENT

Fairing assembly
Pre-launch flight crew ions

GROUP 17: EMERGENCY EQUIPMENT

Canopy severance device
Canopy initiator handle
Portable fire extinguisher
First aid kits

MOS 67S—OH-58D SCOUT HELICOPTER REPAIRER

GROUP 1: AIRFRAME

Pilot/copilot seat restraint components
Corner mount down-stop assembly
Horizontal stabilizer
Access door
Crew door
Crew seat
Forward fairing assembly
Engine cowl assembly
Aft fairing assembly
Wire cutter
Center post duct and doors
Windshield assembly
Cabin roof skylight
Lower window
Honeycomb panels (typical)
Avionics support
Tailboom aft fuselage attach fittings
Tail rotor gearbox support assembly
Tailboom bearing hanger supports
Tail rotor driveshaft cover
Fin assembly
Taillight support
Pylon mounts
Beam assembly
Forward transverse beam
Aft transverse beam
Engine mounts

GROUP 2: ALIGHTING GEAR

Landing gear (crosstubes & skids)
Crosstube support beam assembly
Perform crosstube deflection test

GROUP 3: POWER PLANT

Engine assembly
Particle separator
Engine fuel filter assembly
Cooling systems
Air induction
Forward firewall
Engine oil system
Oil cooler bypass valve
Oil pressure transmitter
Oil tank assembly
Ignition system
Power control
Harnesses
Fuel controls

Fuel control lever/clevis
Engine mount trunnion
Pumps (engine driven)
Ng (gas producer) engine control cable
Perform engine-to-transmission alignment.

GROUP 4: ROTORS

Main rotor hub and blade assembly
Swash plate uniball friction
Main rotor blade(s)
Assist in correcting rotor system vibrations
Mast plate assembly
Main rotor rotating controls
Swashplate and support
Tail rotor hub and blade assembly
Tail rotor assembly
Tail rotor pitch change mechanism

GROUP 5: DRIVETRAIN SYSTEMS

Engine-to-transmission drive shaft
Transmission oil filter
Oil cooler
Transmission
Standpipe electrical assembly
Torquemeter support and bearing assembly
Main rotor mast assembly
Drive shaft and bearing assembly
Fan shaft assembly
Mast mounted site (MMS)
Adapter right pump
Housing assembly
Support and bearing assembly
Mast assembly
Freewheeling housing assembly
Tail rotor assembly
Tail rotor drive shaft and bearing hanger assembly
Tail rotor segmented shaft assembly
Tail rotor drive output adapter
Tail rotor output shaft support
Freewheeling shaft assembly
Tail rotor driveshaft system
Tail rotor shaft assembly fan
Tail rotor blower assembly
Tail rotor gearbox assembly

GROUP 6: HYDRAULIC SYSTEMS

Hydraulic system
Pump
Hydraulic filters
Flush contaminated hydraulic system
Directional control servo actuator
Servo actuators
Cyclic actuator

Hydraulic solenoid valve
Hydraulic reservoir

GROUP 7: INSTRUMENT SYSTEMS

Flight instruments
Digital and analog system
Transmission & engine instruments
Miscellaneous instruments (i.e., clocks)
Panel assembly
Pitot-static instruments
TGT/TRQ indicator
Navigation instruments
Multiparameter displays
Glareshield
Dual tachometer
Airspeed indicator
Attitude indicator
Altimeter indicator

GROUP 8: ELECTRICAL SYSTEMS

Battery
Starter-generator
AC generator
Motors
Lighting
Caution & warning lights
Fault isolation systems
Avionic provisions

GROUP 9: FUEL SYSTEMS

Fuel cell cartridge
Fuel flow & distribution system
Pumps
Valves
Refueling system
Fuel quantity control unit
Fuel boost pump
Receiver assembly

GROUP 10: FLIGHT CONTROLS

Control sticks
Pedals
Push/pull rods, torque tubes
Quadrants, force gradients, control surfaces
Bellcranks, trim actuators (mechanical)
Mixing lever support
Mixing lever assembly
Tail rotor pitch-change control tube
Mixing lever support
Magnetic brake
Directional control support assembly
Trunnion bearing assembly

Copilot stick assembly
Jack shaft assembly
Pilot stick assembly
Panel assembly
Tube assembly
Cyclic stick assembly, copilot
Cyclic stick assembly, pilot
Collective pitch system
Directional controls
Cyclic controls

GROUP 11: ENVIRONMENTAL CONTROL SYSTEMS

Heaters
Defrosters
Heater mixing valve
Ducts
Ventilating system
Plenum assembly
Valve assembly
Blower assembly

MOS 67T—UH-60 TACTICAL TRANSPORT HELICOPTER REPAIRER

GROUP 1: AIRFRAME

- Fuselage skin
- Mid-fuselage assembly
- Honeycomb panels
- Interface panel assembly
- Flight test receptacle
- Head liner assembly
- Head liner support assembly
- Main rotor pylon
- Nose door assembly
- Windshield
- Cockpit doors assembly
- Nose vibration absorber
- Troop/cargo door assembly
- Gunner's door assembly
- Access door assembly
- Troop/gunner's seat assembly
- Pilot/copilot seat assembly
- Operators seat
- Seat tracks
- Tail rotor pylon assembly
- Stabilator assembly
- Stabilator actuator assembly
- Stabilator sensor installation
- Tail cone assembly
- Tail drive shaft fairing
- Canted hinge bulkhead
- Canted hinge fitting
- Soundproofing installation

GROUP 2: LANDING GEAR

- Main landing gear:
 - Drag beams and axles
 - Drag beam switch
 - Main shock strut
 - Kneel valves
 - Wheels and tires
- Main landing gear brake system:
 - Wheel brakes
 - Brake master cylinder
 - Parking brake
 - Valves and switch
 - Handle and mechanism
 - Brake lines and mechanism
- Tail landing gear:
 - Tail shock strut
 - Kneeling valves
 - Air valves

- Fork and yoke and assembly
- Lock activator and mechanism
- Wheel and tire installation
- Tailwheel axle

GROUP 3: POWERPLANT

- Engine installation
- Demountable power package
- Pneumatic engine starter
- Pneumatic tubes
- Engine mounts
- Forward engine support tube assembly
- Power available, load demand spindles
- Engine output shaft assembly
- Control quadrant assembly
- Control cable assemblies

GROUP 4: ROTOR SYSTEMS

Main rotor:

- Hub/head assembly
- Spindle assembly
- Anti-flap assembly
- Droop stops
- Damper assemblies
- Damper indicator
- Pitch control rods
- Swashplate assembly
- Rotating scissors
- Shaft extension
- Bifilar assembly
- Main rotor blades
- Main rotor BIM system

Tail rotor:

- Tail rotor blades
- Pitch control rods
- Pitch beam assembly
- Outboard retention plate

GROUP 5: DRIVE SYSTEM

- Main transmission
- Main module
- Tail takeoff flange
- Gust lock rod and lever
- Input modules
- Accessory modules
- Intermediate gear box
- Tail gear box assembly
- Drive shaft, sections I-IV
- Fan and radiator assembly
- Radiator
- Fan, shaft and duct
- Inboard retention plate

GROUP 6: PNEUDRAULIC SYSTEM

Engine start installation
Tubes and couplings
Bleed-air shutoff valve
Start control valve
Hydraulic pump modules
APU start system
APU accumulator
APU start valve
Transfer modules and manifolds
Utility module
Primary servo manifolds
Pilot-assist module
Pilot-assist manifold
Tail rotor servo 2nd stage shutoff valve
Tubing, hoses, and lines
Secondary hydraulic systems
Refill pump
Selector assembly
Flex hoses and rigid tubing

GROUP 7: INSTRUMENT SYSTEMS

Instrument systems
Pitot-static system
Airspeed indicator
Altimeter
Standby compass
Engine/transmission instruments
Central display unit
Pilot's/copilot's display units
Signal data converter
Caution/advisory panel
Master warning panels
Free-air thermometer

GROUP 8: ELECTRICAL SYSTEMS

AC electrical system
Main generator
APU generator
General control unit (GCU)
DC electrical system
Battery
Conditioner/analyzer battery
APU electrical system (ESU)
Systems interface components
Circuit breakers, fuses and switches
Left- and right-hand relay panels
Fuel boost pump system
Backup hydraulic pump (electrical)
Lighting systems
Landing light assembly
Searchlight assembly
Cyclic stick electrical system

Collective stick electrical system
Cargo hook electrical system
Deicing system
Deicing distributor
Ice rate indicator panel
Deice control panel
Deice controller
Ice detector
Tail rotor slipring assembly
Linear actuator

GROUP 9: FUEL SYSTEM

Fuel system
Fuel cell/installation
Pressure refuel-defuel system
Pressure refueling valve
Refuel-defuel valve
Hi-level shutoff valve
Low-level shutoff valve
Fuel boost pump
Fuel prime pump
Fuel selector valves
Breakaway/self-sealing valves
Fuel lines/hoses

GROUP 10: FLIGHT CONTROLS

Flight controls systems
Cockpit controls installations
Yaw controls installation
Pedal adjuster assembly
Cyclic controls installation
Collective controls installation
Forward upper deck controls installation
Yaw boost servo assembly
Roll SAS assembly
Pitch trim assembly
Collective boost servo
Roll trim actuator
Yaw trim actuator
Mixer assembly
Pitch bias actuator
Primary servo assemblies
Upper deck torque shafts and levers
Midsection bellcranks and shaft
Bellcranks, walking beams, swashplate linkage
Support and push rods
Directional controls installation (forward)
Cables and pulleys, flight control
Tail rotor servo assembly
Tail rotor quadrant assembly

Group 11: ENVIRONMENTAL SYSTEMS

Heat and vent system
Blower unit
Mixture temperature sensor
Mixing valve
High performance rescue hoist assembly
Winch assembly
Cable hook assembly
Boom assembly
Up limit actuator stop
Cable assembly
Full-up limit switches
Post structure/boom position actuator assembly
Stanchion assembly
Mechanical stop assembly
Rotary actuator assembly
Reaction arm assembly
Control panel
Control pendant
Indicator lamp
Air conditioner
Pallet assemblies
Vane fan
Manifold assembly
Electrical box assembly
Ducts
Demister heater
Evaporator heat exchanger
Motor assembly compressor
Evaporator blower
Plenum assembly
Motor assembly
Brake assembly
Chain
Inertia dump assembly

GROUP 12: AUXILIARY POWER UNIT (APU)

Auxiliary power unit (APU)
Fuel pump
Acceleration control
Start motor

GROUP 13: MISSION EQUIPMENT

Chaff dispenser system
IR suppressor installation
HIRSS suppressor installation
Armament installation (mounts)
Aeromedical evacuation kit installation
Blackout device kit
Winterization kit installation
Rescue hoist installation
Cargo hook installation
External stores support system (ESSS)

External stores rack
230 gallon external fuel tank

GROUP 14: AVIONICS

Avionics installation .

MOS 67U—CH-47 MEDIUM HELICOPTER REPAIRER

GROUP 1: AIRFRAME

Fuselage skin
Honeycomb panels
Cabin access, rescue doors
Passenger/crew door assemblies
Pilot and copilot seat assemblies
Acoustical insulation
Forward transmission fairing, work platforms, and panels
Aft transmission support structure
Combining transmission fairing
Beams, attachments and drive shaft brackets
Fuel pods
Cargo loading ramp assemblies and floor
M-24 sub-system mount
Seals and retainer
Troop, troop commander seats
Rescue door actuator
Aft pylon
Aft rotary wing drive shaft support structure
Grounding receptacle (to ferry fuel)

GROUP 2: ALIGHTING GEAR

Shock struts
Strut air valves
Strut grease fittings and tow lug
Torque arm assembly
Wheel and tire assemblies
Wheel bearing
Forward and aft wheel brake disks and linings
Wheel brake units
Drag links
Static lock mechanism
Power steering lever
Forward and aft landing gear axle
Spindle and swivel housing assembly
Swivel locks and springs
Static ground wire
Proximity switch

GROUP 3: POWERPLANT

Demountable powerplant assembly
Fuel boost pump
Engine accessory gearbox chip detector
Starter drive housing
Oil pump
Oil cooler
Oil filler strainer element
Oil filler
Inlet fuel filter

Interstage air bleed band
Air bleed band actuator
Engine access cover
Engine lower access door
Engine mount drag strut, support cap and adapter
Air inlet and bypass screens
Air inlet fairing/engine cowling
Tailpipe
Fireshield former assembly
Control linkages and rods (N1 and N2)
Gas producer control actuator (N1 or N2)
Turbine control actuator (N2 or N1)
Engine condition control assembly
Engine condition control resistor (N2)
Remote positioning control box (N2)
Control box (N1)
Engine condition relay and emergency trim relay
Electrical harness
Engine anti-icing fairing hot air valve
Engine anti-icing ducts
Droop eliminator variable resistors
Fuel/oil lines

GROUP 4: BLADES/ROTOR SYSTEMS

Blade
Blade leading edge erosion strip
Blade leading edge nose cap
Blade fairing
Trim tab
Lag damper assembly
Rib closure inboard and outboard
Lightning protection jumper wire/strip
Tiedown receiver
Rod end sleeve and slot seal
Blade spar
Blade shock absorber (damper)
Rotary wing head
Rotary-wing head tie bar
Fixed droop stops
Centrifugal droop stop assembly
Pitch varying housing and bearing
Pitch varying housing bearing oil tank
Pitch varying housing wear sleeve
Pitch varying housing oil seals
Vertical hinge pin assembly
Horizontal hinge assembly
Pitch varying shaft
Hub oil tank
Liquid sight indicators and plugs
Swashplate assembly
Swashplate bearing
Ball (upper and lower) spherical bearings and sliding sleeve bearings
Spherical ball
Drive arms and drive collar
Pitch link
Weather protective cover and boots

GROUP 5: DRIVE TRAIN SYSTEM

Forward transmission assembly
Forward accessory mounting seals, input/output shaft seals
Forward oil level sight gage
Forward sump
Forward main lube pump and relief valve
Forward auxiliary lube pump
Forward filter elements, main and auxiliary
Forward and aft slider shaft assemblies and seals
Aft transmission assembly
Aft accessory mounting seals, input/output shaft seal
Aft oil level sight gage
Aft sump
Aft main lube pump and relief valve aft transmission
 auxiliary oil pump
Aft filter elements, main and auxiliary
Aft transmission oil cooler fan shaft bearings
Combining transmission assembly
Combining accessory mounting seals input and output shaft seals
Engine/combining oil level sight gage
Engine/combining oil filter and relief valve assembly
Engine/combining oil filter element
Combining auxiliary bypass valve
Combining sump
Engine transmission assembly
Engine transmission output shaft seal
Engine transmission main oil filter pressure differential indicator
Transmission oil coolers
Oil cooler bypass valve
Transmission oil cooler fans
Combining transmission oil cooler fan shaft bearings
Transmission oil cooler fan ducts
Drain valves-transmission sump, tank and filter
Transmission indicating screen/chip detector/temperature transmitter
Fittings and hoses
Transmission breather
Transmission oil screens
Aft rotor drive shaft
Drive shaft assemblies
Drive shaft bearings
Drive shaft adapter & plate assemblies
Drive shaft mounts and bushings
Engine drive shaft assembly

GROUP 6: HYDRAULIC SYSTEM

System decontamination
Flushing pressure lines
Flushing return lines
Filling and bleeding
Tubing
Hoses
Rosan adapters
Flight control No 2 and No 2 power control module
Pivoting and swiveling servocylinder

Lower controls module No 1 and No 2
Lower controls actuating cylinder structural manifold
Intergrated lower controls actuator assembly (ILCA)
No 1 or No 2 flight control reservoir cooler
No 1 or No 2 flight control reservoir/cooler fan
No 1 or No 2 flight control pump
APU start module
APU start accumulator
APU motor/pump
Pressure control module
Engine start valve
Return control module
No 1 or No 2 power transfer unit module
Hydraulic motor and pump
Hand pump
Hydraulic fill module
Engine starter motor
Utility pump
Utility reservoir/cooler
Utility reservoir/cooler fan
Winch motor
Hoist control valve
Hoist pressure reducing valve
Hoist control relief valve
Hoist control shutoff check valve
Brake master cylinder
Parking brake and valve
Brake pressure reducing valve
Brake transfer valves
Emergency brake accumulator
Power steering and swivel lock module
Power steering assembly
Cargo hood release valve
Ramp actuating cylinder
Ramp control valve
Cargo door sequence valve
Cargo door pressure actuated valve
Cargo door motor
Swivel lock actuator
Pivoting and swiveling servocylinder bearings

GROUP 7: INSTRUMENT SYSTEMS

Transmission oil temperature transmitters
Engine transmission chip detector/temperature switch
Cruise guide indicator
Rotor tachometer indicator
Transmission oil pressure indicator and switch
Transmission oil temperature indicator and switch
Hydraulic temperature indicator
Hydraulic temperature probe
Hydraulic pressure indicator
Hydraulic fluid level indicator/signal conditioner
Hydraulic fluid level transmitter (LDVT)
Vertical velocity indicator
Fuel quantity indicator
Fuel quantity selector switch

Fuel quantity tank unit
Mounts, cables, quick disconnects
Fuel flow transmitter
Low fuel sensor
High fuel sensor
Fuel thermistor control unit
Aircraft mechanical clock
Aircraft digital clock
Magnetic compass
Attitude indicator
Turn and slip indicator
Airspeed indicator and restrictor
Barometric altimeter
AIMS altimeter
Free air thermometer
Gas producer tachometer indicator
PTIT indicator
Engine oil temperature indicator
Engine oil temperature transmitter (bulb)
Engine oil pressure indicator
Engine torque indicator
Power supply engine torquemeter
Pitot-static and side slip sensing system
Cyclic trim indicator
Maintenance panel
Magnetic indicator
Light indicator
Instruments panels
Emergency power light
Emergency power switches

GROUP 8: ELECTRICAL SYSTEMS

Main generator
Main generator control panel
Emergency power panel
APU generator
APU generator control panel
APU control box (Esu)
DC power supplies
Main line contactor
Battery
Battery sump jar
Battery charger
Power monitor
Transformer relays
Switches, circuit breakers, and fuses
Terminal board module
Ground device module
Control stick and thrust control grip assemblies
Landing-searchlights
Floodlight
Anticollision lights
Interior lights, navigation lights, switches, and formation lights
Troop warning box
Master caution panel
Console components

Power steering control box
Overhead panel assembly
Cables and connectors
Variable resistors or control transformers
Lamps and lenses
Winch control grip
External power control relay
Hoist/cargo operators
Dual hook relay box
Emergency hook release relay box
Alarm bell and troop warning
Avionics cooling fan
Power distribution panel

GROUP 9: FUEL SYSTEM

Bleed fuel system
Fuel tanks
Fuel cell
Fuel tank vent components
Filler caps
Fuel booster pumps
Fuel system pressure switches
Fuel check valves
Defueling valve
Tank unit wire harness
Booster pump relays
APU fuel boost pump
APU manual fuel shutoff valve
APU fuel solenoid valve
Drain valves
Fuel gate valves
Lines and fittings
Filters, strainers, and screens
Fuel level shutoff valve
Fuel crossfeed valve
Fuel level control valve
Jet pump
Fuel precheck panel
Pressure refueling adapter
Fuel quantity inverter
Suction feed check valve
Engine fuel shutoff valve

GROUP 10: FLIGHT CONTROLS

Dash actuator assembly
Longitudinal cyclic trim (LCT) actuator
LCT yoke assemblies
LCT link
AFCS computer
AFCS computer circuit boards
AFCS panel
Balance springs
Cockpit control assemblies and interconnecting links
Flight control connecting links

Idler link
Control pallets
Thrust detent capsule
Thrust control
Pitch, roll, yaw, and thrust viscous dampers
Damper arms and connecting links
Magnetic brakes
CCDA, thrust and pitch
Spring assemblies, pitch, roll and yaw (artificial feel)
Yaw, pitch and roll position transducer
Pitch and roll control stick
Intermediate bellcranks
Connecting links between intermediate and first stage mixing
First stage bellcranks
Second stage bellcranks
Connecting links between first and second stage and forward
servocylinders
Connecting links between first and second stage mixing
Bellcrank, transfer pitch, thrust, roll, and yaw
Tunnel control arms and idlers
Connecting links between second stage and aft servocylinders
Aft fuselage and pylon, bellcranks
Stick position indicator
Rotor blades
Servocylinder control valve boots

GROUP 11: UTILITY SYSTEMS

Windshield wiper system
Fire detection system
Fire extinguisher system

GROUP 12: ENVIRONMENTAL CONTROL SYSTEMS

Heater unit
Heater fuel control
Heater thermostat & switches
Cabin temperature selector switch
Cabin temperature controller
Shielded lead assembly

GROUP 13: AUXILIARY POWERPLANT SYSTEM

APU assembly
APU exhaust duct
APU aft mounts and link
Electrical harness assembly
Magnetic pickup
Oil filter cap assembly
Filter bypass valve
Oil level gage
Oil pump and baffle plate
Magnetic oil plug
Combustor assembly
Combustor chamber case
Turbine nozzle shield

Turbine wheel
Air inlet housing
Reduction drive assembly

GROUP 14: MISSION EQUIPMENT

General hoist/winch work
Center cargo hook assembly
Center cargo hook support beam and bearings
Forward and aft cargo hook assembly
Paratroop anchor lines assembly
Flare dispenser system
Litters, poles, and straps

MOS 67V—OH-58A/C SCOUT HELICOPTER REPAIRER

GROUP 1: AIRFRAME

Fuselage skin
Jettison mechanism
Honeycomb panels
Crew and passenger doors
Windows (all)
Windshield
Seat assemblies
Protective armor
Sound proofing
Cowling and fairing
Engine mount assembly
Pylon support
Isolation mount
Access doors and panels
Cargo platform
Armament fittings assemblies
Tailboom
Driveshaft cover
Horizontal stabilizer assembly
Vertical stabilizer
Tail skid assembly
WSPS

GROUP 2: ALIGHTING GEAR

Cross tubes
Skid tubes
Skid shoes
Tow rings

GROUP 3: POWERPLANT

Engine (complete assembly)
Exhaust stacks
Hoses, fittings, and tubing
Engine oil cooler
Oil tank
Engine control linkage
Droop compensator linkage
Particle separator
Oil bypass selector valve

GROUP 4: PROPELLER ROTOR SYSTEMS

Main rotor hub assembly
Reservoir and sight glass
Inspect trunnion
Pitch horn trunnion
Latch assembly
Service grip

Pillow block
Blade retention bolt
Pitch horn
Split cone set
Main rotor retaining nut
Main rotor blade assembly
Swashplate and support assembly
Pitch link assembly
Idler link assembly
Mast boot assembly
Collective lever
Collective link assembly
Tail rotor assembly
Tail rotor blade
Inspect bearing
Tail rotor hub assembly
Tail rotor pitch horn
Tail rotor pitch change mechanism
Tension strap

GROUP 5: DRIVE TRAIN SYSTEMS

Main transmission assembly
Oil pump
Input pinion housing adapter and seals
Drag pin assembly
Oil filter and head assembly
Chip detector
Oil cooler
Transmission driveshaft
Mast assembly
Freewheeling assembly
Tail rotor driveshaft assembly
Engine oil cooler blower assembly
Tail rotor gearbox
Intermediate gearbox
Seals

GROUP 6: HYDRAULIC AND PNEUMATIC SYSTEMS

Pump assembly
Reservoirs
Filter assembly
Solenoid valve
Servoactuator
Servo support
Check valves
Pressure switch
Relief valve
Quick-disconnect assembly
Hoses and lines

GROUP 7: INSTRUMENT SYSTEMS

Clock
Free air temperature indicator
DC ammeter
Fuel pressure switch
Fuel quantity indicator
Fuel quantity transmitter
Standby compass
Airspeed indicator
Altimeter
Attitude indicator
Turn and slip indicator
Pitot-static system
Instantaneous vertical velocity indicator
Engine (N2) and rotor tachometer (dual)
TOT indicator and system
Oil temperature indicator
Oil pressure indicator
Torquemeter indicator
Gas producer N1 tachometer
Rotor, N1 and N2 tachometer generator
Temperature transmitter
Transmission oil pressure indicator (OH-58C)
Transmission oil pressure transmitter (OH-58C)

GROUP 8: ELECTRICAL SYSTEMS

Battery
Starter-generator
Voltage regulator
Relays, rheostates, switches, circuits, breakers, connectors, conduits, receptacles, shunts, shocks mounts, and plugs
Wiring
Flasher unit
Fault annunciator panel
Fault annunciator
Warning lights
Landing, navigation, instrument, cabin, map, and anticollision lights
Chip detector system
Linear actuator

GROUP 9: FUEL SYSTEMS

Fuel cell
Boost pump
Low level switch
Shutoff valve
Hoses, lines, and fittings
Closed circuit refueling receiver
Auxiliary fuel system

GROUP 10: FLIGHT CONTROLS SYSTEM

Force gradient
Jackshaft collective control

Cyclic control stick
Magnetic brake
Collective and cyclic linkage
Tail rotor control linkage
Tail rotor pedal assembly
Bearings
Adjustable rod ends
Electromechanical control tube assemblies (OH-58C)
Controlex control (OH-58C)
Rod ends (OH-58C)

GROUP 11: ANTI-ICING SYSTEMS

Tube assembly
Anti-icing lever

GROUP 12: ENVIRONMENTAL CONTROL SYSTEMS

Plenum assembly
Ventilating and defogging valves
Controls
Ducts and hoses
Fan motor
Air mixing valve
Fan motors
Fuel pump and valves
Ignition unit
Fuel filter
Pressure switch
Heater assembly
Fuel pressure relief valve

MOS 67Y—AH-1 ATTACK HELICOPTER REPAIRER

GROUP 1: AIRFRAME

Fuselage skin
Sheet metal for structural members
Honeycomb panels
Transmission mounts
Transmission mount dampers
Windshield
Window assembly
Pilot/gunner door assemblies
Pilot/gunner seat installation
Striker assembly
Soundproofing blanket assembly
Engine deck assembly
Mount assembly
Cowl assemblies
Firewall assembly
Heatshield assembly
Support arms (brace rods, tripod, and bipod)
Pillow block assembly
Wire strike cutters
Wire strike deflector (nose)
Deflector assembly (canopy)
Nose deflector
Tailboom assembly
Wings

GROUP 2: ALIGHTING GEAR

Crosstubes
Skid tubes
Skid shoes
Skid saddles
Ground handling wheels
Pump assembly
Cylinder assembly
Wheel assembly
Skid installation tail

GROUP 3: POWERPLANT

Engine (complete assembly)
Tail pipe
Oil strainers
Droop compensator
Linear actuator
Hoses, fittings, couplings, and tubing
Particle separator
Power lever controls
Engine oil tank
Hoses, fittings, and tubing
Engine oil cooler

Oil cooler shut-off valve
Turbine oil cooler blower
Engine chip detector
Breakaway valves

GROUP 4: ROTOR SYSTEMS

Pylon assembly, external components
Main rotor hub and blade assembly
Main rotor housing assembly
Main rotor pitch horn assembly
Main rotor extension assembly
Drag brace assembly
Grip assembly
Sand deflector
Pitch horn assembly
Extension assembly
Blade retention bolt assembly
Yoke assembly
Trunnion assembly
Trunnion housing assembly
Scissors and sleeve assembly
Scissors link assembly
Collective sleeve
Swashplate and support assembly
Main rotor blades
Tail rotor installation
Tail rotor hub and blade assembly
Link assembly
Crosshead
Tension strap assembly
Tail rotor blades

GROUP 5: DRIVE TRAIN SYSTEM

Intermediate and tail rotor drive gearboxes
Intermediate and tail rotor drive gearbox quills
Tail rotor drive shaft
Tail rotor drive shaft hanger assemblies
Main transmission
Main drive shaft (engine to transmission)
Drive quill assemblies
Lines, manifolds and fittings
Sight gages
Oil jets
Filters, filter housings and screens
Transmission oil cooler assembly
Bypass valve assembly
Oil pump
Mast assembly
Friction collet

GROUP 6: HYDRAULIC & PNEUMATIC SYSTEM

Pumps
Reservoirs
Valves
Solenoid valve
Hose, tubing and fittings
Hydraulic module
Hydraulic servo cylinders
Replace hydraulic accumulator
Accumulator air press gage
SCAS servo actuators

GROUP 7: INSTRUMENT SYSTEMS

Instrument panels
Clock
Free air temperature gage
Volt, load and ammeter
Fuel quantity indicator and amplifier
Vertical velocity indicator
Standby compass
Airspeed indicator
Altimeter
Attitude indicator
Turn and slip indicator
Pitot system
Engine and rotor tachometer
Turbine gas temperature indicator
Engine oil temperature gage
Engine oil pressure transmitter and indicator
Fuel pressure indicator and transmitter
Torquemeter and transmitter
Tachometer, generators
Gas producer tachometer
Oil temperature gage
Oil pressure gage and transmitter
Temperature bulbs
Tank sensor, probes and units
Turbine gas temperature indicator

GROUP 8: ELECTRICAL SYSTEMS

Inverters
Relays, rheostats switches, circuit breakers, plugs, leads, connectors,
conduits, receptacles, shunts, and circuit boards
Wiring
Regulator
Battery
Starter generator
Cooling blower
Lights
Alternator
Navigation, instrument, interior cabin, anti-collision, and flasher
units
Search light assembly

Caution panels
RPM warning control box
Chip detector system

GROUP 9: FUEL SYSTEM

Main fuel tanks, both crashworthy and non-crashworthy
Fuel low level warning system
Boost pumps
Valves and fittings
Filter assembly
Hoses, tubing and filler caps
Fuel drain valves
Fuel cells

GROUP 10: FLIGHT CONTROLS

Main rotor control tubes and rod ends
Force gradient assembly
Control stick (collective and cyclic)
Synchronized elevator assembly
Magnetic brake assembly
Collective and cyclic linkage
Tail rotor pedal assembly linkage
Pedal adjusting assembly
Tail rotor pitch control linkage
Tail rotor pitch control mechanism
Tail rotor pitch change rods and links
Control panel
Control box
Solenoid valves, hoses, connectors
Transducers

GROUP 11: ENVIRONMENTAL CONTROL SYSTEMS

Bleed air heater system
Control valves
Vent blower
Ventilating ducts, inlet door, and control
Environmental control unit
Heater exchanger
Temperature control sensor
Temperature control valve
Torque motor
Turbine assembly
Cockpit outlet nozzles
Pressure regulator and shut-off valve
Solenoid valve
Pressure relief valve
Temperature selector
Rain removal system
Hot air valve

GROUP 12: MISSION EQUIPMENT ARMAMENT

Pilot gun sight
Pilot gunner's control panels
Emergency jettison system
Ejector rack
Grenade dispenser
Accelerometer resolver
Servo-electronic control unit
Hydraulic power cylinder
Armament pods
Rocket pods

GROUP 13: EMERGENCY EQUIPMENT

Canopy removal system
Emergency hydraulic pump

GROUP 14: AVIONICS

Avionics installation

MOS 68B—POWER PLANT REPAIRER

GROUP 1: SHARED TASKS (All A/C)

Engine systems
Engine vibration checks
JET CAL
Quick change assembly (QCA) build-up
Foreign object damage (FOD)

GROUP 2: SYSTEM T-53 (UH-1, AH-1)

GROUP 2a: COMPRESSOR SECTION

Output shaft seal & oil transfer tubes
Overspeed governor & tachometer drive support and gear assembly
Overspeed governor & tachometer drive support assembly internal seals
Impeller housing
Compressor housing
Compressor stator vanes
Compressor rotor blades
Power shaft/reduction gear carrier
Air inlet housing
Air inlet vanes
Variable air inlet guide vane assembly
Interstage bleed band actuator assembly
Air diffuser housing
Rear bearing seal, seal housing, seal liner, and rear cones
Reduction carrier & gear assembly

GROUP 2b: COMBUSTOR POWER TURBINE SECTION (HOT END)

No. 2 bearing and forward and aft seals
1st stage gas producer (GP) nozzle and cylinder
1st stage GP rotor
2nd stage GP nozzle
2nd stage GP rotor
3&4 bearing, bearing housing, and seals
1st stage power turbine (PT) nozzle (3rd nozzle)
1st stage PT rotor (3rd rotor)
2nd stage PT nozzle (4th nozzle)
2nd stage PT rotor (4th rotor)
Combustion chamber deflector
Combustion liner
Exhaust diffuser
Combustion chamber housing
Fire shield
Rear bearing, aft seal housing
Rear bearing, forward seal housing, & forward read
Coil rings/cones
Rear bearing & bearing housing

GROUP 2c: ACCESSORY GEARBOX

Accessory drive gearbox
Chip detector
Oil temperature bulb
Accessory drive external gearbox
Seals
Accessory drive carrier assembly

GROUP 2d: FUEL SYSTEM

Fuel & oil hose assembly
Fuel control assembly
Fuel control solenoid valve
Fuel control filters & strainers
Main fuel filter
Starting fuel solenoid
Main fuel manifold
Starting fuel manifold
Starting fuel nozzles
Flow dividers & dump valve

GROUP 2e: ELECTRICAL SYSTEM

Ignition unit
Igniter plugs
Exhaust thermocouple assembly
Thermocouple harness assembly
Electrical cable assembly & ignition leads & coil assembly
Hot air solenoid valve
Main electrical harness

GROUP 2f: OIL SYSTEM

Power-driven rotary (oil) pump
No. 2 (rear), 3 & 4 bearing housing oil strainers
Lube oil filter assembly
Power-driven rotary (booster) pump (torque meter boost pump)
Oil transfer support assembly

GROUP 3: SYSTEM T-55 (CH-47)

GROUP 3a: COMPRESSOR SECTION

Output shaft seal & oil transfer tubes
Impeller housing
Compressor housing
Anti-king gallery
Compressor stator vanes
Compressor rotor blades
Air inlet housing
Interstage bleed band actuator assembly

Air diffuser housing
No. 2 & 3 bearing
No. 6 & 7 bearing
Output shaft support

GROUP 3b: COMBUSTION SECTION

1st stage gas producer nozzle and cylinder
1st and 2nd gas producer rotors
2nd stage gas producer nozzle and cylinder
No. 2 Bearing package and seals
Deflector
Combustion vane assembly
Combustion chamber housing
Combustion chamber liner
Combustion case assembly
Combustion drain
3rd turbine nozzle (1st power turbine)
3rd rotor assembly (1st power turbine)
4th turbine nozzle (2nd power turbine)
4th turbine rotor (2nd power turbine)
No. 4 & 5 bearing package
Exit guide valves
PTIT probes
PTIT jumper
Bus bar assemblies
Fire shield
Exhaust vane assembly
Thermocouple harness system
Thermocouple and harness assemblies
Curl assembly

GROUP 3c: ACCESSORY GEARBOX

Accessory drive gearbox
Starter drive
No. 3 bearing (with engine installed)
Accessory drive gear

GROUP 3d: FUEL SYSTEM

Fuel check valve
Fuel & oil hose assembly
Start fuel solenoid valve
Fuel control assembly
Fuel boost pump
Fuel control filters & strainers
Fuel filter impending bypass indicator
Starting fuel primer tubes
Main fuel manifold
Main fuel filter
In-line fuel filter & element assembly
Starting fuel nozzles
Flow dividers

GROUP 3e: ELECTRICAL SYSTEM

- Ignition exciter
- Igniter spark plugs
- Thermocouple harness assembly
- Thermocouple jumper assembly
- Electrical cable assembly
- Ignition leads
- Coil assembly
- Main electrical cable assembly
- Right & left hand bus bars
- Torquemeter junction box
- Torquemeter output shaft
- Torquemeter head assembly

GROUP 3f: OIL SYSTEM

- Oil pump
- Oil level float
- Oil cooler
- Oil lines
- Oil filter assembly
- Oil level indicator
- Oil drain valve
- Oil filter strainer
- Oil filter cap & stem
- Temperature transmitter
- Starter gearbox filter
- Scavenge oil screen
- Dual chip detector

GROUP 4: SYSTEM T-63 (OH-58A,C)

GROUP 4a: COMPRESSOR SECTION

- Compressor assembly
- Rotor assembly
- Compressor case halves (OH-58C)
- Air inlet vanes
- Compressor bleed valve
- Air diffuser scroll
- Diffuser vent orifice vent tube
- Oil pressure reducer

GROUP 4b: COMBUSTION SECTION (HOT MODULE)

- Combustion chamber housing/liner (outer case)
- Discharge air tubes

GROUP 4c: POWER-TURBINE

Turbine assembly
1st stage nozzle assembly
1st stage nozzle shield
1st stage turbine blades
Burner drain valve

GROUP 4d: ACCESSORY GEARBOX

External seals
External studs
Magnetic chip detector
Accessory drive gearbox external seals

GROUP 4e: FUEL SYSTEM

Fuel control assembly
Fuel control filters
Fuel pump
Fuel filter
Fuel nozzles
Governor
External lines and hoses
Double check valve
PC air filter

GROUP 4f: ELECTRICAL SYSTEM

Exciter assembly
Spark igniters
Spark igniter lead
Auto reignition control (OH-58A)
Thermocouple assembly
Thermocouple terminal assembly

GROUP 4g: OIL SYSTEM

Oil filter housing
Oil filter assembly
Oil pressure regulator
Internal oil check valve
External oil check valve
External lines and fittings

GROUP 4h: MISCELLANEOUS EQUIPMENT

FAT thermometer
Turbine Outlet
Temperature (TOT) gage
Tachometer

GROUP 5: SYSTEM T-700 (UH-60A, AH-64)

GROUP 5a: COMPRESSOR SECTION

Compressor section module
Main frame
Swirl frame
Front frame
Main frame borescope plug
Scroll case
Inlet separator boot
Inlet guide vane actuating ring
Inlet guide vane actuator levers
Inlet guide vanes
Compressor case
Stage 5 vane sectors
Stages 1 & 2 vane actuating rings
Stages 1 & 2 vane actuator levers
Cap & plug (borescope ports)
Compressor rotor assembly
Impeller
Stages 1, 2 & 5 blade-disks
Diffusers and mid-frame casing assembly
Mid-frame borescope port plug
Actuating system linkage assembly
Forward suspension lug
A-sump output shaft assembly
No. 1 carbon seal
Power takeoff drive assembly
Oil inlet & scavenge tubes

GROUP 5b: COMBUSTION SECTION

Combustion module
Stage 1 nozzle assembly
Combustion liner
Stages 1 & 2 gas generator
Turbine rotor
Gas generator stator
Face type seal
Curvic coupling seals

GROUP 5c: POWER-TURBINE

Power turbine module
C-sump cover & heat shield
Exhaust frame
Stage 4 turbine rotor blades
Stage 4 seal & turbine nozzle
Turbine case
Stage 3 turbine nozzle & segments
Outer turbine duct
Turbine drive shaft assembly

GROUP 5d: ACCESSORY GEARBOX

Inlet duct borescope plug
Particle separator blower & V-band coupling assembly
Particle separator inlet duct
Accessory drive gearbox assembly
Axis-a cover assembly (radial drive shaft cover assembly) and retaining ring
Axis-a boot (radial drive shaft cover boot)
Radial drive shaft assembly
Axis-a lube nozzle
Accessory gearbox

GROUP 5e: FUEL SYSTEM

Primer nozzle
Main frame manifold
Fuel start feed tube
Fuel injector assemblies
Fuel start manifold tube
Fuel boost pump
Hydromechanical control unit and grooved clamp coupling
Fuel filter
Gearbox-to-fuel control hose assembly
Fuel pressure sensor
Overspeed & drain valve manifold assembly
Overspeed & drain valve
Pressurizing & overspeed unit (POU) manifold assembly
Pressurizing & overspeed unit
Manifold assembly (T701)

GROUP 5f: ELECTRICAL SYSTEM

Igniter plugs
Electrical control unit (T700, T701 or digital electronic control (T701C)
Electrical control unit scroll seal
History recorder
Electrical ignition leads
Ignition excite assembly
Alternator stator
Thermocouple assembly
Power turbine speed and torque sensor assembly (torque and overspeed sensor)
Electrical cable assemblies (W3, W4, W5)
Power turbine and torque sensor (NP sensor)
Alternator rotor

GROUP 5g: OIL SYSTEM

Lube oil cooler
Lube (oil) and scavenge pump
Scavenge screens
Oil filter bypass sensor
Electrical chip detector
Oil filter bowl & indicator assembly

C-sump forward scavenge tube
C-sump aft scavenge tube
B-sump drain tube
Oil tank cap and adapter
Lube (oil) manifold assembly
Oil supply tubes
B-sump oil inlet check valve
Main frame oil strainer
Fluid level indicators (oil level)
Oil drain plug
Oil drain insert
Mid C-sump scavenge tube
Oil temperature sensor (T700, T701C)
Oil pressure sensor
B-sump delta pressure tube

GROUP 5h: AIR SYSTEMS FOR T700, T701 ENGINES

P3 hose and tube assembly (T700)
Anti-icing bleed duct
Anti-icing inlet guide vane duct
Anti-icing inlet guide vane feed tube
Anti-icing bleed and start valve, seal housing, retainer, lanyard & clip
assembly
Forward seal pressure tube
Sensing tube
Compressor leakage air tube
Seal pressure & scavenge tube assembly

GROUP 6: SYSTEM T-703 (OH-58D)

GROUP 6a: COMPRESSOR SECTION (COLD MODULE)

Engine assembly
Compressor module
Compressor rotor assembly
Compressor scroll
Oil pressure reducer assembly

GROUP 6b: COMBUSTION SECTION (HOT MODULE)

Combustion module
Combustion outer case
Combustion liner

GROUP 6c: POWER-TURBINE

Turbine module
Horizontal fire shield

GROUP 6d: ACCESSORY GEARBOX

Accessory gearbox module
Oil filter housing assembly
Oil pressure regulator valve

GROUP 6e: FUEL SYSTEM

Fuel system
Fuel control
Fuel pump
Fuel injector
LP fuel filter assembly

GROUP 6f: ELECTRICAL SYSTEM

Electrical harness
Ignition exciter
NP overspeed solenoid

GROUP 6g: ANTI-ICE SYSTEMS FOR T703 ENGINES

Anti-ice system
Anti-ice solenoid valve
Anti-icing air valve

**GROUP 7: AUXILIARY POWER UNIT (APU)—APU T6240-1 (UH-60A), APU T62T2B
(CH-47D), APU GTCP-36-55 (AH-64)**

GROUP 7a: COMPRESSOR SECTION

Engine assembly
Air inlet screen
Compressor section (cold section module)
Compressor rotor

GROUP 7b: COMBUSTION SECTION

Combustion section (hot section module)
Combustor assembly
Exhaust duct
Combustor chamber case
Nozzle shield
Combustor liner

GROUP 7c: POWER-TURBINE

Power turbine assembly
Power turbine housing

GROUP 7d: ACCESSORY GEARBOX

Accessory gearbox assembly (T-62T-2A/2A1)

GROUP 7e: FUEL SYSTEM

Fuel control assembly
Fuel pump
Acceleration control
Fuel inlet filter

Fuel injectors
Fuel start nozzle
Fuel start nozzle restrictor
Main and fuel solenoid valves
Fuel drain valve
External lines and fittings
Fuel pressure switch (T-62T-2A/2A1)

GROUP 7f: ELECTRICAL SYSTEM

Ignition exciter
Ignition cable
Igniter spark plug
Engine electrical harness assembly
Magnetic pick up
Exhaust thermocouple (T-62T-2A/2A1)
Speed switch (T-62T-2A/2A1)
Junction box (T-62T-2A/2A1)

GROUP 7g: OIL SYSTEM

Oil filter
Oil level gage
Oil filler cap assembly
Oil sump
Oil pressure switch
Magnetic oil plug

MOS 68D—POWERTRAIN REPAIRER

GROUP 1: UH-1 DRIVETRAIN SYSTEM

Main transmission
Mast assembly
Input drive quill
Offset quill
Hydraulic pump and tachometer
Output drive quill
Main drive shaft
Oil jets
Tail rotor drive shaft hanger
Tail rotor gearbox
Intermediate gearbox
Tail rotor drive shaft

GROUP 2: UH-1 ROTOR SYSTEM

Main rotor hub
Tail rotor hub & blade assembly
Stabilizer bar
Drag brace assembly
Bolt blade retention
Blade shock absorber
Grip
Shield
Tension strap assembly
Pitch horn
Trunnion
Pillow block
Yoke
Plate

GROUP 3: UH-1 CONTROLS SYSTEM

Scissors, sleeve (bearings)
Link scissors (bearings)
Swash plate and support
Transmission adapting parts

GROUP 4: AH-1 DRIVETRAIN SYSTEM

Transmission
Main drive shaft
Mast assembly
Hydraulic pump and tachometer
Oil jets
Intermediate gearbox
Tail rotor gearbox
Tail rotor drive shaft hanger
Tail rotor drive shaft
Output drive quill
Input drive quill

Offset quill
Alternator quill
ECU quill

GROUP 5: AH-1 ROTOR SYSTEM

Main rotor
Hub and blade assembly
Rotary wing head
Tension torsion strap
Yoke
Yoke extensions
Fittings
Bearings
Grips
Pitch horns
Drag braces
Bolt assemblies
Trunnion
Center trunnion
Tail rotor hub
Tail rotor bearings
Tail rotor trunnion
NDI tail rotor

GROUP 6: CH-47D DRIVETRAIN SYSTEM

Forward slider shaft seal
Forward slider shaft
Aft slider shaft
Forward transmission
Forward transmission input seal
Forward transmission output seal
Aft transmission
Aft transmission input seal
Aft transmission output seal
Combining transmission repairs and seals
Engine transmission
Engine transmission output shaft seal
Oil cooler blowers
Aft rotary wing drive shaft
Aft rotary wing drive shaft seal
Drive shaft assemblies
Drive shaft bearing
Synchronizing drive shaft

GROUP 7: CH-47D ROTOR SYSTEM

Pitch varying housing oil tank
Vertical hinge pin bearing oil tank
Hub oil tank
Rotary wing head
Vertical hinge pin bearing
Vertical hinge pin oil seals
Horizontal hinge pin
Horizontal hinge pin bearing

Horizontal hinge pin seals
Pressure test seals
Balance and track rotor systems
Vertical hinge pin oil manifold tube
Vertical hinge pin oil tank
Pitch varying bearing oil tank

GROUP 8: CH-47D CONTROLS SYSTEM

Swashplate
Uniball spherical bearing
Spherical ball
Drive arms and collar
Drive arm bearings
Pitch link
Pitch link bearings
Shock absorber
Inboard bearing
Rod end bearing
Rotating ring bearing
Sliding sleeve bearing

GROUP 9: UH-60 DRIVETRAIN SYSTEMS

Input modules
Accessory modules
Accessory seals
Intermediate gearbox
Intermediate gearbox input/output seals
Drive shaft
Drive shaft viscous damper bearing
Main transmission
Main transmission output seal
Tail takeoff flange
Tail takeoff flange seal
Oil cooler
Oil cooler fan
Oil cooler shaft
Shaft bearing
Tail gearbox
Tail gearbox input/output seals
Gimble input seals

GROUP 10: UH-60 ROTOR SYSTEM

Balance and track main rotor
Balance and track tail rotor
Anti flow assembly
Main rotor hub assembly
Spindle assembly
Droop stop assembly
Damper assembly
Tail rotor pitch control rod
Tail rotor pitch beam
Bifilar
Bifilar weights

Spindle horn
Tail rotor retention plate
Tail rotor paddles
Anti-flap stop

GROUP 11: UH-60 CONTROLS SYSTEM

Pitch control rods
Pitch control rod upper bearing
Pitch control rod lower rod end bearings
Swashplate
Spherical bearings
Rotating scissors
Rotating upper scissors bearing
Rotating lower scissors bearing
Uniball
Duplex bearings
Scissors attachment spherical bearings

GROUP 12: OH-58 DRIVETRAIN SYSTEM

Input pinion housing, adapter and seal
Oil cooler
Tail rotor gearbox
Main transmission
Transmission drive shaft
Freewheeling assembly
Tail rotor gearbox seals
Transmission oil pump
Freewheeling unit
Mast assembly

GROUP 13: OH-58 ROTOR SYSTEM

Balance main rotor
Balance tail rotor
Main rotor blades
Main rotor grip seals
Main rotor grips bearings
Tail rotor blades
Tail rotor hub
Tail rotor gearbox
Rotary wing head
Tension straps
Tail rotor trunnion
Hub pitch horn
Grips

GROUP 14: OH-58 CONTROLS SYSTEM

Pitch link
Idler link
Collective lever
Collective link

Tail rotor pitch change rod
Tail rotor bearings
Swashplate and support
Swashplate duplex bearing

GROUP 15: AH-64 DRIVETRAIN SYSTEM

Main transmission
Main transmission generator seal
Main transmission input pinion seal
Main transmission APU input seal
APU driveshaft
Main transmission compressor seal
Main transmission output seal
Main transmission rotor brake seals
Transmission cover
Main transmission input drive clutch
Transmission housing assembly
Engine input (No. 1 & 2) drive shaft
Tail rotor drive shaft (No. 3,4,5,6)
Main transmission driveshaft
Engine nose gearbox
Intermediate gearbox
Intermediate gearbox input coupling, flange & fan assembly
Intermediate gearbox output seal
Intermediate gearbox input seal
Tail rotor gearbox
Tail rotor gearbox input pinion gear seal
Tail rotor drive seal
Tail rotor gearbox output seal
Rotor brake actuator
Engine nose gearbox quill shaft
Main transmission lube oil pump (primary)
Vaneaxial fan
Driveshaft couplings
Piston sub-assembly
Main drive plate
PTO clutch
Rotary pump
Float valve
Filler cap
Oil filter
Anti-flail assembly

GROUP 16: AH-64 ROTOR SYSTEM

Balance rotary wing head
Balance tail rotor head
Balance rotary rudder blade
Rotor pitch housing insert
Main rotor mast mounting bolt
Shoe assembly
Main rotor upper seal and retainer
Tail rotor fork assembly
Main rotor lead-lag link bearing retainer
Main rotor mast support base retaining plate

Stretch strap pack assembly
Main rotor feather bearing housing
Droop stop follower assembly
Main rotor striker plate
Main rotor damper

GROUP 17: AH-64 CONTROLS SYSTEM

Aft hanger bearings
Main rotor swashplate
Tail rotor swashplate
Magnetic brake
Tail rotor support

MOS 68F—AIRCRAFT ELECTRICIAN

GROUP 1: LIGHTING SYSTEMS

Interior lighting systems
Exterior lighting systems
Night vision goggles (NVG) lighting system

GROUP 2: INSTRUMENT SYSTEMS

Aircraft pressure indicating systems
Pitot-static system
Aircraft temperature indicating systems
Tachometer indicator system
Vertical instrument display system (VIDS/IDS)
Air temperature indicators
Air data systems
Turbine gas temperature (TGT) indicating system (UH 60/AH-1/AH-64)
Exhaust gas temperature (EGT) indicating system (UH-1/fixed wing)
Power turbine inlet temperature (PTIT) indicating system (CH-47)
Turbine outlet temperature (TOT) indicating system (OH-58/fixed wing)
Central display panel (UH-60)
Airspeed/direction sensor (AADS)
Airspeed indicator system
Altitude indicator system
Turn/slip indicator system
Vertical speed/velocity indicator system
Altimeter system (drum type)
Barometer altimeter system
Torquemeter indicating system
Transmission oil pressure indicating system
Engine oil pressure indicating system
Transmission oil temperature indicating system
Engine oil temperature indicating system

GROUP 3: POWER DISTRIBUTION SYSTEM

Starter generator system
DC power distribution system
DC generator
Voltage regulator system
DC loadmeter circuit
DC voltmeter circuit
Inverter system
AC power distribution system
AC generator
Transformer system
AC loadmeter circuit
Starter system
Auxiliary power unit (APU) system
Nickel-cadmium batteries (with sensors)
Battery analyzing system
Hydraulic leak detection system (UH-60)

GROUP 4: FLIGHT CONTROL SYSTEMS

Flight linear control actuators
Flight control indicator
Horizontal situation indicator (HSI) system
Stabilator system
Hydraulic flight control system
Vertical situational indicator system (VSI)

GROUP 5: FUEL SYSTEMS-ELECTRICAL

Fuel quantity indicating systems
Fuel boost/fuel valve system (UH-1)
Fuel electrical system
Backup hydraulic system circuit (UH-60)

GROUP 6: ENVIRONMENTAL SYSTEMS

Electrical heating system
Bleed air heater system
Combustion heater system (CH-47)
Environmental control system (ECS)
Rain removal system (AH-1)
Engine anti-icing system
Windshield anti-icing system (UH-60)
Structural de-icing system (fixed wing)
Blade de-icing system (rotary wing)

GROUP 7: HOIST/WINCHES-ELECTRICAL REPAIR

Cargo hook systems
Hoist systems (CH-47)

GROUP 8: GROUND SUPPORT EQUIPMENT MAINTENANCE

Gasoline engine generator set
Diesel engine generator set
Auxiliary ground power unit (AGPU) wiring harness

GROUP 9: CAUTION/ADVISORY SYSTEMS

Caution/advisory system
RPM warning system
Engine-Out warning system (AH-64)
RPM warning box
Magnetic chip detector
Fire detector system
Fire extinguisher systems (UH-60/CH-47/AH-64)
Fire bottle system

GROUP 10: ELECTRICAL WIRE

Drag beam switch (UH-60)
Engine electrical harness
Electrical wiring

Auxiliary power unit (APU) wiring harness (UH-60/CH-47)
External power circuit
Electrical connectors
Solid state circuit card
Electrical component corrosion checks
Mast terminal connector (MTS)
Common termination system (CTS) (AH-64)

GROUP 11: AH-64 SPECIFIC

Digital augmentation stabilator equipment system (DASE)
Electrical engine system
Wire/circuit protection (Ray Chem)

GROUP 12: OH-58D SPECIFIC

AC electrical power system (engine running)
AC electrical power system (inverter operational)
Battery charger monitor system
Powerplant electrical system
Fuel probe indicating system
Engine instrument system
Rotor instrument system
Transmission instrument system
Mast torque system
Transmission electrical system
Pitot-static air data systems
Night vision goggles (NVG) system
NVG power supply
Force gradient detent switch
DC electrical system
Lighting/utility electrical system
Drivetrain electrical system
Vertical scale instrument system
1553B data buss

MOS 68G—STRUCTURAL REPAIRER

GROUP 1: MAIN ROTOR BLADE REPAIR

Composite-constructed main rotor blades
Fiberglass-covered, honeycomb-structured rotor blades (CH-47)
Metal-covered honeycomb-structured rotor blades (UH-1, AH-1, & OH-58)
Fixed-wing movable flight control surfaces
Kevlar lag damper bracket winding
Lag damper bracket bushing
Blade tie-down receivers (CH-47)

GROUP 2: HONEYCOMB CONSTRUCTED STRUCTURAL SECTIONS

Sandwich-constructed honeycomb structural sections

GROUP 3: TRANSPARENT PLASTIC REPAIR

Thermosetting (reinforced fiberglass) plastic items
Perform lacing repair to transparent plastics
Perform contour overlay repair to transparent plastics

GROUP 4: WINDOWS

Windows
Outboard windshield (UH-60A)

GROUP 5: LAYOUT PROCEDURES FOR STRUCTURAL REPAIR

Layout structural parts
Layout rivet patterns for structural repair

GROUP 6: SPECIAL PURPOSE FASTENERS

Hi-shear rivets
Hi-lock fasteners
Jo-bolts
Pull-type lockbolts
Nut plates
Dzus fasteners
Camloc fasteners
Rivnuts
Friction lock rivets
Blind-type lockbolts

GROUP 7: GENERAL AIRCRAFT RIVETS

Universal head solid shank rivets on aircraft (hand method)
Countersink head solid shank rivets on aircraft (squeeze method)
Countersink head solid shank rivets on aircraft (hand method)
Countersink head solid shank rivets on aircraft (pneumatic method)
Mechanical lock rivets

GROUP 8: CORROSION REPAIR (painting)

Corrosion on aircraft structural metals
Aircraft assemblies and components
Aircraft marking identifications (e.g., letters/numbers/insignia)

GROUP 9: AIRCRAFT STRUCTURAL MEMBER REPAIR

Stringers and longerons
Formers and bulkheads
Stress skin by lap (SCAB) patch method
Stress skin panels
Doublers/stiffeners
Flush patch clear of internal structures

GROUP 10: DEICER SYSTEM

Deicer system
Deicer Boots

GROUP 11: METALS

Aluminum alloys to remove heat-treatment/strain hardening
Aluminum (annealed "0") repair parts
Aircraft metals

MOS 68H— HYDRAULIC/PNEUDRAULIC REPAIRER

GROUP 1: PNEUDRAULICS

Hydraulic systems
Hose assemblies
Wheelbrake assemblies
Tail rotor servo/actuators
Main rotor servo/actuators
Pneumatic actuators
Power steering assemblies
Power steering actuators
Ramp actuating cylinders
Wheelbrake assemblies
Wheelbrake master cylinders
Park brake valves
Hydraulic valves, solenoid operated
Pneumatic valves
Pneudraulic systems
Pneudraulic landing gear shock
Tubing
Accumulators
Shock absorbers/dampers, main rotor
Air pressure regulators
Fabricate tubing
Fabricate hose assemblies
Operate D-5 hydraulic test stand
Operate the multiservice unit (MSU)
CH-47D tasks:
 Hand pump
 Reservoir cooler
 Brake system
 Integrated lower control actuator
 No. 1 & 2 power transfer module

MOS 68J—AIRCRAFT ARMAMENT/MISSILE SYSTEMS REPAIRER

GROUP 1: GROUND SUPPORT EQUIPMENT

M28 functional test stand
Hydraulic electrical portable power cart (HEPC-1)
AN/GSM-249 HSS fire control subsystem (FCS) test set
M65TSGMS monitor control unit (MCU)
M65TSGMS infrared (IR) target assembly
Perform operational checks/service on M135 rocket management subsystem (RMS)
Perform operational checks/services on M161 fire control computer (FCC) test set
Perform operational checks/services on M143FCS test set
Boresight AH-1S armament subsystems using BAGSE
Perform alignment checks on BAGSE

*** Model S Cobra ***

M28 analyzer test set
Organizational/analyzer test set
PT1145D/M80 rocket system tester
PT1118 intervalometer test set

GROUP 2: TURRET SUBSYSTEM AND WEAPONS

M197 20-MM automatic gun and accessories
M97A1/A2 universal turret subsystem using M137 test set
M197 Automatic gun and associated components
M137 universal turret subsystem test set
M97A3/A4 ammunition feed system
M97A3/A4 turret
M97A3/A4 gun control unit (GCU)
M97A3/A4 logic control unit (LCU)
M97A3/A4 gunner's control panel (GCP)
M97A3/A4 pilot's control panel (PCP)
M97A3/A4 turret control assembly (TCA)
M97A1/A2 universal turret subsystem
Perform operational checks and services on M97A1/A2 universal turret subsystem
Perform quick bore sight of M197 automatic gun

*** Model S Cobra ***

M134 machine gun and associated components
M129 grenade launcher and associated components
M28A2/A3 armament subsystem
Organizational/analyzer test set
7.62-mm magazine assembly
40-mm gun drive assembly
M28A2/M28A3 weapons turret
M28A2/M28A3 gunner's armament control panel (GACP)
M28A2/M28A3 electronic components assembly (ECA)
M28A2/M28A3 right/left weapon controllers
M73 pilot's relex sight
Safe M28A2/A3 armament subsystem

M28A2/A3 armament subsystem using distant aiming point
M28A2/A3 armament subsystem weapons and accessories
M28A2/A3 armament subsystem
M28A2/A3 armament subsystem
Perform operational checks and services on M28A2/A3 armament
subsystem
Boresight M28A2/A3 armament subsystem using boresight target method

GROUP 3: MISSILE SYSTEM MAINTENANCE

M65 armament subsystem
Test set, M65 guided missile system (TSGMS)
M65TOW missile system (TMS) control panel (TCP)
M65TMS stabilization control amplifier (SCA)
M65TMS missile command amplifier (MCA)
M65TMS pilot steering indicator (PSI)
M65TMS electronic power supply (EPS)
M65TMS sight hand control (SHC) unit
M65TMS telescopic sight unit (TSU)
Interface control unit (IFCU)
Servo electronic components unit (SECU)
Perform operational checks/services on M65 articulated pylons
Perform operational checks and services on M65 armament subsystem
Perform operational checks and services on TSGMS
Encased TOW missiles on aircraft launchers
Encased TOW missiles from aircraft launchers
M65 TML using boresight assembly ground support equipment (BAGSE)
Boresight M65 armament subsystem

GROUP 4: ROCKET SYSTEM

XM138 rocket management subsystem using XM135 test set
Wing stores ejector rack impulse cartridges
XM135 test set
2.75 inch rocket launchers
M200A1 rocket launchers (19 shot)
M158A1 rocket launchers (7 shot)
M260/M261 2.75-inch rocket launchers
AH-1 wing stores control panel
AH-1 wing stores control panel
M147 operations unit (OU)
M147 display unit (DU)
2.75-inch rocket launchers
Perform operational checks and services on 2.75-inch rocket
launchers/subsystems
Boresight 2.75-inch rocket launchers using target method
Perform operational checks and services on XM135 test set
Perform operational checks and services on AH-1 wing stores ejector
racks
Perform operational checks and services on articulated pylons

GROUP 5: FIRE CONTROL

M128/M136 helmet sight subsystem using AN/GSM 249 test set
Fire control computer (XM22)
Helmet sight assembly on SPH-4 helmet

M76 HUD

XM143 HUDS first control subsystem test set

AN/GSN-249HSS fire control subsystem test set

XM141 FCC fire control subsystem test set

M128/M136 linkage assemblies

M128/M136 electronic interface assembly (EIA)

Circuit cards

Perform operational checks and services on M128/M136 helmet
sight subsystem (HSS)

Boresight M128/M16 helmet sight subsystem (HSS)

Perform operational checks and services on XM141 FCC test set

Perform operational checks and services on XM143 test set

Perform operational checks and services on XM76 heads-up display
subsystem

*** Model S Cobra ***

M73 reflex sight

Rocket systems using PT-1145 test set

Intervalometers using PT-1118A test set (AVIM)

GROUP 6: AIR-TO-AIR STINGER (ATAS)

Perform ATAS Service-upon receipt procedures

Perform ATAS preventive maintenance checks and services

Perform ATAS maintenance of pilot control panel

Perform ATAS maintenance of missile sight subsystem

Perform ATAS maintenance of interface electronics assembly

Perform ATAS maintenance of launcher assembly

Perform maintenance of ATAS pylon assembly

Perform ATAS maintenance boresighting

Perform ATAS preparation procedures for storage or shipment

GROUP 7: AH-64 WIRE & CP EQUIPMENT

Raychem MTC connector

Soldertact connection from coaxial cables

Soldertact connection from twisted pair cables

TMS cable markers

GROUP 8: AH-64 MULTIPLEX (MUX) SYSTEM

MUX system

Maintenance operational check/fault-isolate MUX system

FD/LS fault isolation of MUX system

Fire control system (FCC)

FCC system battery

Symbol generator (SG)

SG random access memory

SG cell channel

SG power supply

GROUP 9: AH-64 TADS/PNVS SYSTEMS

Optical relay column assembly (ORT)

Control panel assembly

Alphanumeric display

Right or left handgrip

Indirect view display (IVD)
TADS turret assembly
TADS power supply
TADS/PNVS environmental control system (ECS)
TADS electronic control amplifier (TECA)
Maintenance operational check of TADS
Boresight assembly
Wiring harness (aircraft or internal)
Day sensor assembly
Television sensor assembly
Laser tracker/receiver assembly
Laser transceiver unit
Rate gyro assemblies
Day sensor subassembly
Lamp assembly
Laser electronics unit
TADS electronic unit
Night sensor assembly (NSA)
Night sensor shroud assembly
NSA postamplifier assembly
NSA preamplifier assembly
Pilot night vision sensor (PNVS)
Maintenance operational check of PNVS
PNVS turret assembly
PNVS torquer amplifier (electronic control)
PNVS azimuth drive gimbal assembly
PNVS shroud assembly
PNVS electronic unit

GROUP 10: INTEGRATED HELMET SYSTEMS

Integrated helmet unit (IHU)
Perform fitting of IHU
Integrated helmet & display sight system (IHADSS)
Maintenance operational check of IHADSS
Pilot's display adjust panel (DAP)
DAP high voltage power supply
Display electronic unit (DEU) circuit card assembly
Video recorder
Maintenance operational check of video recorder system

GROUP 11: AREA WEAPONS SYSTEMS

Area weapons system (AWS)
Maintenance operational check of AWS
Azimuth & elevation resolvers
Turret control box
Gun control box
Rounds counter/magazine controller (RC/MC)
Sprocket wheel
Breech bolt
Vertical driveshaft (M230)
Breech assembly
Bearing assembly
Rod & clevis
Shaft retaining plate

Bevel gear
Reservoir piston assembly
Drive assembly pinion
Stow assembly stop extension
Cradle support fork trunnion & bearing
90 degree end turn assemblies driveshaft
Accelerator assembly outer rotor drive shaft
Merger assembly rotor
Carrier drive rotor shaft
Tensioner sprocket
Chute roller
Chute assembly
Upload/download using linked ammunition
Upload/download using bulk ammunition
M230 30mm automatic chain gun
Gun drive motor (M230)
AH-64 gun turret
Turret assembly (AH-64)
Servo valve (AH-64)
AH-64 ammunition magazine

GROUP 12: EXTERNAL STORES SYSTEM (ESS)

External stores system (ESS)
Maintenance operational check of ESS
External stores controller
AH-64 pylon assemblies
Pylon rack
Gun turret actuator & top plate assembly
Pylon breech assembly
Aerial rocket control system (ARCS)
Maintenance operational check/fault-isolate ARCS
ARCS station director
M261 rocket launcher
Upload/download rockets
Point target weapon system (PTWS)
Maintenance operational check/fault-isolate on PTWS
Remote hellfire electronics (RHE) and power supply
Electronics command signal processor (ECSP) power supply & multiplex CCA
M272 rocket launcher
Upper rail
Lower support assembly
Upload/download Hellfire missile & domecover
Chaff dispenser system
Maintenance operational check of Chaff dispenser system
Chaff dispenser system (Kit B)
Upload/download Chaff

GROUP 13: AH-64 BORESIGHTING

Perform CBHK self-check
Perform total systems boresight
Boresight AH-64 weapons systems

MOS 68N/L/Q/R —AVIONICS REPAIRER

GROUP 1: AVIONICS SYSTEMS

- Intercommunication system
 - Intercom controls
 - Intercom connecting cables
 - Intercom switch
- UHF radio system
 - UHF/AM radio set
 - UHF/AM receiver-transmitter
- VHF system
 - VHF-AM radio set
 - Receiver-transmitter
 - VHF-FM radio set
 - Receiver-transmitter
 - VHF-AM/FM radio set (AH-64A, CH-47D)
 - FM radio system (AH-1)
 - Receiver-transmitter
 - Filter
 - Communication antenna
 - Homing antenna
 - VHF radio system (AH-1)
 - Transceiver
- Secure communications system
 - Controls
 - Security voice system
- ADF/direction finder set
 - Receiver
 - Controls
 - Antenna
 - Radios
 - Impedance matching amplifier
- VHF omni radios (UH-1)
- Doppler navigation set
 - Receiver/transmitter-antenna
 - Computer/control display
 - Signal data converter
- Transponder system
 - Receiver-transmitter
 - Controls
 - Antenna
- Gyro system
 - Turn rate gyro
 - Vertical gyro
- Radar altimeter set
 - Receiver-transmitter
 - Altimeter indicator
 - Antenna
- Digital augmentation stabilator equipment (DASE)
 - Computer
 - Transducer (linear variable differential transducer)
- IFF system
 - IFF transponder

- Receiver-transmitter
- Computer
- Attitude heading reference system (HARS)
- HF system (CH-47D)
- VOR/MB/GS system (UH-60)
 - Receiver
 - Controls
- Command instrument system (UH-60)
- Heading reference system (UH-1)

GROUP 2: FLIGHT CONTROL SYSTEMS

- Cyclic control system
- Vertical stabilizer
- Stabilator assembly
 - Actuator
 - Amplifier (UH-60)
- Stabilization system (UH-60A)
 - SAS/FPS computer
 - SAS amplifier
 - Stabilator amplifier control panel
 - Lateral accelerometer
 - Collective stick position sensor
- Pitch control stick position actuator (CH-47D)
- Auto pilot (stability augmentation system) (CH-47D)
 - Speed trim indicators
- Stability control augmentation system (AH-1)
 - Sensor amplifier unit
 - Control panel
 - Control motion transducer

GROUP 3a: A/C SURVIVABILITY EQUIPMENT (ASE)

- Radar detection/warning system
 - Radar comparator
 - Radar receiver
 - Radar warning indicator
 - Control assembly
 - Antenna
- Laser detection/warning system
- Counter measures systems
 - Receiver/transmitter
 - Control unit
- Chaff dispenser system

GROUP 3b: MAST MOUNTED SIGHT SUBSYSTEM (OH-58D)

- Turret assembly - MTA
- Processor - MSP
- Power supply - MCPS
- Laser range finder/designator
- Thermal imaging system
- Television sensor
- Gyro electric assembly - GEA
- Internal multiplex electrical assembly
- Airborne target handover system

GROUP 4: INSTRUMENTS

Panel installation instruments:

- Dim/test unit engine
- Turbine gas temperature indicator
- Engine torque indicator
- Fuel quantity indicator
- Engine gas generator indicator
- Engine/rotor RPM indicator
- Engine oil pressure indicator
- Selectable digital display panel
- Display unit (UH-60)
- Signal data converter (UH-60)

Flight instruments:

- Compass magnetic
- Airspeed indicator
- Altimeter indicator
 - Altitude components
- Attitude indicator
 - VOR/LOC/ADF course indicator (CH-47D)
- Horizontal situation indicator
- Altimeter pressure
- Vertical velocity indicator
- Mechanical accelerometer
- Stabilization indicator
- Radio magnetic indicator
- Video display unit
- Pitot static system (UH-60)
- Advisory & warning system
 - Caution/advisory panel
- Nose video recorder

GROUP 5: ELECTRICAL SYSTEM

- AC system
- DC system
- Battery & charger
 - System exterior lighting systems
- Interior lighting systems

BIBLIOGRAPHY

United States Army Aviation Logistics School, *Programs of Instruction for Helicopter Maintenance Occupational Specialties in Career Management Field 67*, 1991.

United States Army Aviation Logistics School, Aviation Apprentice Mechanic, briefings, 1989 and 1990.

United States Army Aviation Systems Command, *UMSDC Aviation Field Monitor's Guide*, June 1985.

United States Army Aviation Systems Command, *UMSDC Aviation User's Guide*, August 1989.

United States Army Materiel Command Materiel Readiness Support Activity, *Work Order Logistic File (WOLF) User's Manual*, January 1990.

United States Army Military Personnel Center, *Enlisted Master File Automated Data System Manual*, July 1982.

Army Occupational Survey Program Documents

United States Army Occupational Survey Program, *AOSP Enlisted Incumbent Questionnaire: MOS 66J/68J Aircraft Armament Technical Inspector/Aircraft Armament/Missile System Repairer*, SCN:ATNC-AO-89-1, August 1989.

United States Army Occupational Survey Program, *AOSP Enlisted Incumbent Questionnaire: MOS 68F Aircraft Electrician*, SCN:ATNC-AO-90-1, November 1990.

United States Army Occupational Survey Program, *AOSP Enlisted Incumbent Questionnaire: MOS 68H Aircraft Pneudraulics Repairer*, SCN:ATZI-NOS-86-1, November 1985.

United States Army Occupational Survey Program, *AOSP Enlisted Incumbent Questionnaire: MOS 68G Aircraft Structural Repairer*, SCN:ATNC-AO-88-1, August 1988.

United States Army Occupational Survey Program, *AOSP Enlisted Incumbent Questionnaire: MOS 35K,35L,35M,35P,35R Aviation Communications Electronics System Maintenance*, SCN:ATZI-NOS-86-1, April 1986.

Soldier's Manuals for Helicopter Maintenance MOSs

United States Department of the Army, *Soldier's Manual: Utility Helicopter Repairer MOS 67N*, STP 55-67N12-SM, November 1984.

United States Department of the Army, *Soldier's Manual: AH-64 Attack Helicopter Repairer MOS 67R*, STP 1-67R12-SM, September 1987.

United States Department of the Army, *Soldier's Manual: MOS 67S Scout Helicopter Repairer*, STP 1-67S12-SM, December 1988.

United States Department of the Army, *Soldier's Manual: MOS 67T Tactical Transport Helicopter Repairer*, STP 55-67T12-SM, October 1984.

United States Department of the Army, *Soldier's Manual: Medium Helicopter Repairer MOS 67U*, STP 1-67U12-SM, July 1987.

United States Department of the Army, *Soldier's Manual: Observation / Scout Helicopter Repairer MOS 67V*, STP 55-67V12-SM, May 1984.

United States Department of the Army, *Soldier's Manual: Attack Helicopter Repairer MOS 67Y*, STP 55-67Y12-SM, September 1984.

United States Department of the Army, *Soldier's Manual: MOS 68B Aircraft Powerplant Repairer*, STP 55-68B12-SM, October 1984.

United States Department of the Army, *Soldier's Manual: MOS 68D Aircraft Powertrain Repairer*, STP 55-68D12-SM, November 1984.

United States Department of the Army, *Soldier's Manual: MOS 68F Aircraft Electrician*, STP 55-68F13-SM-TG, October 1987.

United States Department of the Army, *Soldier's Manual: MOS 68G Aircraft Structural Repairer*, STP 55-68G12-SM, November 1984.

United States Department of the Army, *Soldier's Manual: MOS 68H Aircraft Pneudraulics Repairer*, STP 55-68H12-SM, November 1984.

United States Department of the Army, *Soldier's Manual: MOS 68J Aircraft Armament / Missile Systems Repairer*, STP 1-68J12-SM, October 1987.

Technical Manuals and Maintenance Allocation Charts for Army Helicopters

United States Department of the Army, *Technical Manuals: Maintenance Allocation Charts*, TM 55-1520-237-23, TM 55-1520-234-23, TM 55-1520-220-23-3, TM 55-1520-238-23, TM 55-1520-210-23-3, TM 55-1520-227-23-5, TM 55-1520-240-23, TM 55-1520-248-23, TM 55-1520-228-23, TM 55-2835-203-24, TM 55-2835-205-23, TM 55-2840-256-23, TM 55-2840-231-23, TM 55-2840-254-23, TM 55-2840-229-23, TM 55-2840-241-23, TM 55-2840-248-23.

Wild, William G., Jr., and Bruce R. Orvis, *Design of Field-Based Crosstraining Programs and Implications for Readiness*, RAND, R-4242-A, forthcoming.